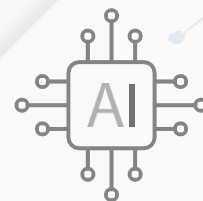




DHANALAKSHMI SRINIVASAN COLLEGE OF ENGINEERING (AUTONOMOUS)

COIMBATORE - 641 105 | www.dsce.ac.in



Date : 11.10.2025, 10.31 a.m

Venue : A Block Seminar Hall

National Conference on EMERGENCE OF ARTIFICIAL INTELLIGENCE

MACHINE LEARNING & COMPUTING POWERS

Organized by

AI&DS, Agri, BME, Civil, CSE, CSE(Cyber),
ECE, EEE, Food Tech & Mech

Professional Societies

IEEE, IETE, AFSTI, ISME, ISTE, ISAE,
BMESI, ICI, YI & AIMO

GUESTS



Dr. E. Chandira Sekaran

Professor,
Electrical & Electronics Engineering,
Coimbatore Institute of Technology,
Coimbatore.

Keynote Address I



Dr. Chakradhar Dupadu

Associate Professor,
Mechanical Engineering,
IIT Palakkad.

Keynote Address II



Dr. J. Preethi

Assistant Professor,
Computer Science & Engineering,
Anna University (Regional Campus),
Coimbatore.

Keynote Address III



Dr. T. Arumuganathan

Principal Scientist,
Sugarcane Breeding Institute,
Coimbatore.

Session Chair



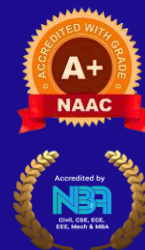
Mr. J. Visweswaran

Country Manager,
ARK Infosolutions Pvt. Ltd.,
Bengaluru.

Session Chair



DHANALAKSHMI SRINIVASAN COLLEGE OF ENGINEERING (AUTONOMOUS) **COIMBATORE - 641 105 | www.dsce.ac.in**



The Management, Principal, Staff and Students cordially
solicit your esteemed presence for the

National Conference on Emergence of Artificial Intelligence Machine Learning & Computing Powers

11.10.2025 | 10.31 a.m

Venue : A Block Seminar Hall

Shri. P. NEELARAJ
Secretary
presides



Prof. Dr. G. KULANTHAIVEL

Professor & Head, Dept of ECE,
NITTTR, Chennai.

Chief Guest

delivers the Inaugural Address

in the presence of

Dr.VINOTH NEELARAJ
Director

Dr. C. JEGADHEESAN
Principal
felicitates

All are Welcome!

Agenda

Inaugural Session

10.31 am	➤ Commencement of Inaugural Function
10.32 am - 10.35 am	➤ Invocation
10.35 am - 10.40 am	➤ Lighting of Kuthuvilakku
10.40 am - 10.45 am	➤ Welcome Address
10.45 am - 10.50 am	➤ Introduction of Guests
10.50 am - 10.55 am	➤ Honouring the Guests
10.55 am - 11.05 am	➤ Release of Proceedings (Hard Copy & Soft Copy)
11.05 am - 11.15 am	➤ Presidential Address
11.15 am - 11.25 am	➤ Inaugural Address (Prof. Dr. G. Kulanthaivel)
11.25 am - 11.35 am	➤ Keynote Address I (Dr. E. Chandira Sekaran)
11.35 am - 11.45 am	➤ Keynote Address II (Dr. Chakradhar Dupadu)
11.45 am - 11.55 am	➤ Keynote Address III (Dr. J. Preethi)

Session Details

Timings	Session I : 12.15 pm - 1.15 pm
	Session II : 1.45 pm - 2.45 pm

Session Chair	Department	Venue
Prof. Dr. G. Kulanthaivel	BME & ECE	B-03
Dr. E. Chandira Sekaran	EEE	B-06
Dr. Chakradhar Dupadu	Civil & Mech	B-12
Dr. J. Preethi	CSE & CSE(CS)	B-13
Dr. T. Arumuganathan	Agri & Food Tech	B-14
Mr. J. Visweswaran	AI&DS	B-104

Valedictory Session

3.15 pm - 3.45 pm	➤	Distribution of Certificates
3.45 pm - 3.50 pm	➤	Vote of Thanks
3.50 pm - 3.55 pm	➤	National Anthem

About the College

Nestled away from the odds of the city life, located in aesthetically designed buildings along the Western Ghats in 19 acres of sylvan surrounding, is DSCE. The college works continuously to propagate technical education for the advancement of students with the right attitude and requisite skills to accelerate them into higher stratum in their respective fields.

DSCE, **an Autonomous Institution**, in alignment with its vision "Towards Excellence", is accredited by **NAAC with A+ (3.42/4)** in its very first cycle of accreditation. All the eligible courses (Civil, CSE, ECE, EEE, Mech and MBA) are provisionally accredited by **NBA**. CSE, ECE, EEE, Mech and MBA courses are permanently affiliated to Anna University, Chennai.

The college has received **AICTE IDEA** lab and also **three star rating in IIC**. The college is categorized under 2(f) and 12(B) of the UGC Act. The college over the years continues to leave behind its indelible footprints on young lives through transformative education, nurturing innovation & extensive collaboration.



Center of Excellence



Incubation Center



Academic & Industry Partners





SECRETARY MESSAGE

As we stand at the threshold of a new era defined by rapid technological advancement, it is my distinct honor and pleasure to welcome you to this year's **National Conference on Emergence of Artificial Intelligence, Machine Learning & Computing Powers**. The world around us is being reshaped at an unprecedented pace, and this year, we focus our gaze firmly on the **Future Trends** that will redefine industries, societies, and the human experience.

The journey we embark upon today is not merely about presenting research; it is about cultivating a spirit of pioneering innovation. Success in the coming decades will belong to those who not only understand current trends but who also possess the vision and skills to invent the next ones. This conference serves as a crucible where transformative ideas are forged, a space where curiosity is nurtured, bold, and disruptive concepts are celebrated.

At **Dhanalakshmi Srinivasan College of Engineering (Autonomous), Coimbatore**, our mission has always been to set benchmarks for excellence and to equip our students and faculty to lead this charge. Recognizing that technologies such as **Artificial Intelligence, Quantum Computing, and Sustainable Engineering** are converging to address some of the world's most complex challenges, we are deeply committed to integrating future-oriented learning into every facet of our academic environment. We do not just teach the future; we strive to shape the minds that will build it.

This **National Conference on Emergence of Artificial Intelligence, Machine Learning & Computing Powers** is more than a symposium; it is a dynamic ecosystem for knowledge sharing and meaningful collaboration. Over the day, we will explore into groundbreaking research, explore innovative ideas that transcend disciplinary boundaries, and foster partnerships that will accelerate the pace of technological and societal development.

May your time here be filled by vibrant discussions, illuminating discoveries, and the creation of lasting professional connections. I wish this **National Conference on Emergence of Artificial Intelligence, Machine Learning & Computing Powers** a grand success and hope it serves as a powerful catalyst for the remarkable contributions you are all destined to make in shaping a smarter, more sustainable world.



DIRECTOR MESSAGE

It is with immense pride and great enthusiasm that I extend a sincere and heartfelt welcome to all participants, esteemed delegates, researchers, and thought leaders attending this year's **National Conference on Emergence of Artificial Intelligence, Machine Learning & Computing Powers**.

At **Dhanalakshmi Srinivasan College of Engineering (Autonomous), Coimbatore**, we believe that the role of a premier educational institution extends far beyond imparting knowledge, it lies in pioneering innovation. We stand at a pivotal moment where the convergence of fields like Artificial Intelligence, Sustainable Engineering, and Advanced Data Analytics is redrawing the global technological landscape. Our mission is to be a dedicated center for innovation and a launchpad for future pioneers who will navigate and shape this new world.

This conference is a direct reflection of that institutional vision. It serves as a vital convergence point where cutting-edge theory meets practical application, and where today's disruptive research evolves into tomorrow's robust solutions. We are committed to fostering an academic ecosystem that inspires collaboration, creativity, and critical thinking, nurturing the next wave of global innovation.

Our greatest strength lies in our core belief that true success is achieved by empowering individuals to become visionary leaders and ethical problem-solvers. By hosting this national event, we reaffirm our commitment to nurturing a global community of scholars—one dedicated not only to groundbreaking research, but also to the responsible and impactful advancement of technology.

I encourage all participants to make the most of this exceptional platform to engage in spirited debates, collaborate across disciplines, and challenge conventional thinking. Let this conference be the catalyst that transforms emerging ideas into tangible, meaningful realities.

I wish the **National Conference on Emergence of Artificial Intelligence, Machine Learning & Computing Powers** the greatest success, and look forward to the remarkable insights and enduring collaborations that will undoubtedly emerge from this vital forum.



PRINCIPAL MESSAGE

The landscape of technical education in India is currently undergoing a profound transformation. We are moving beyond adaptation and into an era that demands active pioneering. As the AICTE has recognized, and as global conditions continuously reinforce, the imperative is not just to address present requirements but to chart a strategic course for futuristic needs.

At DSCE, we are absolutely committed to being at the forefront of this change. Our mission is to integrate future-forward learning across all disciplines with the critical mindset and technological fluency necessary to contribute substantively to the Technological, Economic, and Social development of the nation. We are dedicated to providing training and quality education that is continuously updated to reflect the most disruptive trends in Engineering and Technology.

I take immense pride in our institution's role as the host for this prestigious National Conference on Emergence of Artificial Intelligence, Machine Learning & Computing Powers. This conference is more than an event; it is a confluence of eminent minds—researchers, academicians, and industry experts—gathered to explore and define the Future Trends that will shape our world.

This platform provides a unique opportunity for presenting the latest groundbreaking research, engaging in vibrant intellectual exchange, and forging critical collaborative partnerships. We firmly believe that the insights and discussions generated here will inspire next-generation innovations and accelerate the practical application of cutting-edge technologies.

I extend my deepest appreciation to the organizers, the distinguished speakers, and all the participants for your commitment to this vital scholarly endeavor. May your experience be profoundly enriching and highly successful.



DEAN MESSAGE

It is a distinct pleasure to welcome all distinguished delegates, researchers, faculty, and students to this year's National Conference on Emergence of Artificial Intelligence, Machine Learning & Computing Powers.

At the heart of Dhanalakshmi Srinivasan College of Engineering (DSCE), Coimbatore, lies a resolute commitment to advancing intellectual frontiers. Our focus this year is to have direct recognition that innovation is born at the intersections of established fields. We are currently witnessing an unprecedented era of convergence, where Artificial Intelligence, Machine Learning, and high-powered computing are not just evolving, but are actively redefining the boundaries of every scientific discipline.

This conference serves as the ultimate expression of our academic mission: to foster a culture of inquiry that encourages deep, high-quality research. It is a vital platform designed to facilitate the rigorous exchange of knowledge, groundbreaking methodologies, and disruptive insights that will inform the next generation of academic curricula and industry best practices.

This event is a collaborative ecosystem where brilliant minds dedicate themselves to solving the complex challenges of tomorrow. We take immense pride in hosting a forum that not only showcases cutting-edge technical advancements but also stimulates thoughtful deliberations on the ethical, social, and global implications of these emerging technologies.

I encourage you to embrace the dynamic environment of national conference. Dive deep into the research, forge meaningful interdisciplinary collaborations, and utilize this opportunity to elevate your work. May your engagement here be a catalyst for the finest intellectual outcomes, leading to solutions that offer both profound technical quality and significant societal gratification.

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DEPARTMENT OF AGRICULTURAL
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ADVANCES IN AUTOMATION FOR IRRIGATION SCHEDULING: COMPREHENSIVE REVIEW

Balachandrakumar¹, Sindhuesh², Puviksha³, Karthi⁴

¹ Assistant Professor, ^{2,3,4} Ug scholar,

Agricultural Engineering, Dhanalakshmi Srinivasan College of Engineering, Coimbatore.

Abstract: Advances in automation for irrigation scheduling have become a critical component of precision agriculture, aiming to optimize water use efficiency, crop productivity, and sustainability in the face of increasing water scarcity. Automated irrigation systems integrate soil moisture sensors, weather-based models, remote sensing, and decision support tools to enable real-time monitoring and site-specific water management (Evans & Sadler, 2008). Additionally, remote sensing and UAV-based platforms contribute large-scale spatial data for precision irrigation, improving decision-making at the field and regional levels (Jones et al., 2018). Despite these advancements, challenges such as high implementation costs, interoperability of devices, farmer training, and data management remain barriers to widespread adoption. This review provides a comprehensive synthesis of technological innovations, applications, and future research directions in automated irrigation scheduling, with an emphasis on sustainable water management for agriculture.

Key Words: *Irrigation scheduling, weather-based models, remote sensing.*

AI-ASSISTANT CHILLI NURSERY TRANSPLANTER WITH IOT INTEGRATION FOR REAL-TIME MONITORING

Vetrivel Kumar¹, Nivetha², Bastindanial³, Hariharan⁴

¹ Professor, ^{2, 3, 4} Ug scholar,

Agricultural Engineering, Dhanalakshmi Srinivasan College of Engineering, Coimbatore.

Abstract: The integration of Artificial Intelligence (AI) and Internet of Things (IoT) technologies in nursery transplanters offers transformative potential for precision agriculture, especially within chilli (*Capsicum annuum* L.) cultivation. This paper presents the concept, design, and preliminary results of an AI-assisted chilli nursery transplanter equipped with IoT-enabled real-time monitoring capabilities. These data streams are processed via innovative AI algorithms for noise elimination, anomaly detection, and actionable decision-making. Upon identifying thresholds such as low soil moisture or pest presence, actuators like pumps and fans are automatically engaged to optimize growing conditions. Real-time reports and dashboard alerts keep farmers informed, enabling remote supervision and timely intervention. Initial prototype tests show enhanced operational efficiency, with the system actuating irrigation and exhaust fans in response to sensor triggers and achieving a pest detection rate of up to 75%.

Key Words: *AI, Internet of Things (IoT), Chilli Nursery, Transplanter, Real-Time Monitoring.*

ADVANCES IN MICROCLIMATE MONITORING AND CONTROL FOR GREENHOUSE-BASED PROTECTED CULTIVATION – REVIEW

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Abstract: Greenhouses are controlled environments that significantly enhance crop production and quality, particularly in regions with challenging climates (Sagheer et al., 2020). This protected cultivation method mitigates weather-related risks, pest infestations, and diseases, thereby optimizing crop yields (Soussi et al., 2024). However, managing these multi-factor systems efficiently presents a complex optimization problem impacting resource utilization and overall yield (Hai-xia et al., 2021). The integration of advanced sensor technologies and real-time data analytics is critical for achieving these precise environmental controls, allowing for intelligent adaptation and optimization of conditions (Maraveas & Bartzanas, 2021). This advanced approach, often referred to as precision agriculture, leverages dedicated sensor-based systems to monitor crop growth, ensuring efficient and accurate management while minimizing resource consumption like water, CO₂, and fertilizers (Kamarianakis et al., 2024).

Key Words: *Greenhouse, Microclimate, Crop Production.*

AI VISION AND IOT-CONTROLLED MECHANISATION FOR GAP FILLING IN VEGETABLE CULTIVATION

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Abstract: The integration of AI vision and IoT-controlled mechanisation is reshaping precision vegetable cultivation, especially in identifying and addressing planting gaps. Computer vision systems paired with sensor networks enable real-time field monitoring and gap detection. Deep learning supports autonomous replanting and soil correction, while IoT ensures seamless data transfer for predictive control of irrigation, nutrients, and microclimate. This approach minimizes labour, optimizes inputs, and enhances yield consistency. Field results show improved land use and plant uniformity, pointing toward scalable and sustainable farming practices suitable for diverse environments.

Keywords: *Artificial Intelligence (AI), Computer Vision, Internet of Things (IoT), Vegetable Cultivation, Gap Filling, Precision Agriculture, Smart Mechanisation.*

AI-POWERED MULTI-VEGETABLE NURSERY TRANSPLANTER WITH IOT FOR TOMATO, CHILLI, AND BRINJAL

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Abstract: The rising need for precision agriculture has emphasized automating nursery transplantation for crops like tomato, chilli, and brinjal. Traditional manual methods are labour-intensive, time-consuming, and often result in inconsistent spacing. This study presents an AI-powered multi-vegetable nursery transplanter integrated with IoT for real-time monitoring. Utilizing computer vision and machine learning, the system detects and positions seedlings with uniform spacing and depth. IoT modules relay machine and soil data to a cloud-based dashboard for continuous performance tracking and decision-making. Designed for multi-crop adaptability, the system minimizes manual effort, enhances transplant accuracy, and increases operational efficiency. Field tests confirm substantial labour savings and improved planting consistency, supporting its potential for scalable smart farming solutions.

Key Words: Precision Agriculture, AI, IoT, Nursery Transplanter, Tomato, Chilli, Brinjal, Automation.

AUTOMATION IN GRAIN STORAGE AND HANDLING SYSTEMS

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Abstract: Automation in grain storage and handling systems plays a crucial role in improving efficiency, preserving quality, and reducing post-harvest losses. Conventional storage and manual handling methods often result in spoilage, pest attacks, and high labour demand. This study explores the integration of sensor-based monitoring, automated conveyors, temperature and humidity control, and robotic handling to optimize grain storage operations. These technologies enhance food security, safety, and cost-effectiveness while minimizing human intervention. The paper also addresses challenges such as high installation costs, system integration, and the requirement for skilled operators. Future developments involving IoT and AI are discussed for predictive maintenance and intelligent decision-making, promoting sustainable and efficient grain management practices.

Key Words: Automation, Grain Storage, Handling Systems, Sensors, Agricultural Engineering.

AUTOMATION IN NURSERY TRANSPLANTING OF LEAFY VEGETABLES LIKE SPINACH AND LETTUCE

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Abstract: This paper presents the development of an automated nursery-to-field transplanting system designed for leafy vegetables such as spinach (*Spinacia oleracea*) and lettuce (*Lactuca sativa*). The system integrates a mechanized seedling extractor, precision metering conveyor, and a robotic pick-and-place arm equipped with a soft gripper. Vision-based localization ensures accurate positioning, while the adaptive planting module maintains uniform depth and spacing to protect root integrity. The control system allows operators to set crop-specific parameters through a user-friendly interface. Field evaluations indicate the automated transplanter achieves a survival rate above 92% and planting precision within ± 5 mm depth and ± 10 mm spacing, while reducing labour by up to 65% and achieving throughput of 1200–1600 seedlings per hour. The system is adaptable to different tray types and seedling ages, offering a cost-effective solution for commercial leafy-vegetable growers. Challenges such as handling delicate seedlings and maintaining root-ball stability are discussed, along with strategies for improvement and integration with precision farming systems.

Key Words: Automated Transplanting, Nursery Automation, Robotic Transplanting, Precision Agriculture, Leafy Vegetables, Machine Vision, Soft Grippers, Spinach, Lettuce.

AUTOMATION-DRIVEN FARM MECHANIZATION: FROM SMART IRRIGATION TO PRECISION HARVESTING

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Abstract: Global agriculture is undergoing a rapid transformation with the rise of automation and advanced mechanization technologies. Traditional farming methods, often labor-intensive and resource-inefficient, are being replaced by intelligent systems that enhance productivity, sustainability, and resilience. Automation-driven farm mechanization includes innovations such as sensor-based smart irrigation, autonomous tractors, drones, and GPS-enabled precision harvesting. Smart irrigation systems utilize real-time data from soil moisture, weather sensors, and satellite imaging to optimize water use and reduce wastage. Similarly, automated machinery enables site-specific operations, minimizes labor dependency, and improves input efficiency. These technologies collectively enhance productivity while reducing the environmental footprint through precise resource management. Despite their advantages, challenges such as high initial costs, lack of technical expertise, and limited infrastructure hinder widespread adoption in developing regions.

Key Words: Farm Mechanization, Automation, Smart Irrigation, Precision Harvesting, Sustainable Agriculture.

AUTONOMOUS MACHINERY AND ROBOTICS: TRANSFORMING INDUSTRIES THROUGH INTELLIGENCE AND AUTOMATION – REVIEW

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Abstract: Autonomous machinery and robotics are revolutionizing agriculture through the integration of artificial intelligence (AI), machine learning, and precision technologies to enhance efficiency, sustainability, and productivity. Equipment such as autonomous tractors, robotic harvesters, unmanned aerial vehicles (UAVs), and AI-based monitoring systems are increasingly used for planting, irrigation, weed control, and harvesting, significantly reducing labor needs and improving operational precision. These systems enable data-driven, site-specific crop management, optimizing resource utilization and reducing environmental impacts. Recent developments show their potential to address challenges such as workforce shortages, climate uncertainty, and the growing global food demand. This review discusses major advancements, applications, and challenges of autonomous agricultural robotics while emphasizing future research directions for sustainable, wide-scale implementation.

Key Words: *Autonomous Machinery, Robotics, Precision Agriculture, AI, Weed Management, Automation.*

DESIGN OF MULTICROP SEEDING ROBOT WITH AI CONTROL FOR CEREAL AND OILSEED

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Abstract: Modern agriculture faces challenges such as climate variability, soil degradation, and inefficient input utilization. Equipped with sensors, GPS navigation, and computer vision, the robot adapts to varying soil conditions and crop types with minimal manual intervention. Machine learning algorithms enable real-time decision-making for seed dispensing and field mapping, improving planting uniformity and reducing wastage. IoT-based connectivity allows data collection for monitoring seed rate, soil parameters, and field coverage through a cloud dashboard. Field evaluations demonstrate significant improvements in planting accuracy, labour efficiency, and seed utilization compared to conventional methods. The integration of AI and automation in seeding operations marks a step toward sustainable, data-driven, and intelligent farming systems for multi-crop production.

Key Words: *AI Control, Multicrop Seeding Robot, Precision Agriculture, Automation, Cereal, Oilseed.*

INTELLIGENT THINNING OF LETTUCE CROPS USING IOT-INTEGRATED ROBOTIC SYSTEMS

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Abstract: This paper presents an IoT-integrated robotic system designed for intelligent thinning of lettuce crops to enhance growth efficiency and yield quality. The system employs smart sensors and computer vision to monitor plant health, detect overcrowded or underperforming seedlings, and selectively remove weaker plants. Using AI-based decision algorithms, the robot autonomously analyzes environmental and crop data in real time to optimize thinning actions with minimal human intervention. This precision approach improves spacing uniformity, promotes healthy crop development, and reduces input waste such as water and fertilizer. Additionally, IoT connectivity enables continuous data collection and monitoring through cloud-based platforms, facilitating better farm management decisions. Overall, the system contributes to sustainable, resource-efficient, and automated crop production practices.

Key Words: *Intelligent Lettuce Thinning, IoT-Integrated Robotics, Smart Agriculture, Autonomous Crop Management, Precision Agriculture, Real-Time Crop Monitoring.*

DEVELOPMENT OF LOW-COST HARVESTING MACHINERY FOR SMALL-SCALE CHILLI AND TOMATO FARMERS

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Abstract: Small-scale chilli and tomato farmers often depend on manual harvesting methods that are labour-intensive, time-consuming, and costly. To overcome these challenges, this study focuses on the design and development of a low-cost harvesting machine suitable for small and marginal farmers. The proposed system uses simple mechanical components and locally available materials to ensure affordability, portability, and ease of maintenance. Developed with direct farmer input, the machine is optimized for crop characteristics and field conditions while minimizing fruit damage. Field evaluations show a significant reduction in harvesting time and labour requirements, improving efficiency and maintaining crop quality. Its lightweight, user-friendly design makes it ideal for rural areas with limited access to technical support. Beyond technical benefits, this innovation enhances farmers' livelihoods, promotes sustainable practices, and supports better market participation through affordable mechanization.

Key Words: *Chilli, Tomato, Harvester, Small-Scale Farmer, Mechanization, Low-Cost Machinery.*

DIGITAL FARMING: SOIL NUTRIENT ASSESSMENT USING IOT SENSORS AND AI ANALYTICS

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Abstract: Digital farming is revolutionizing agriculture through the integration of IoT and AI technologies to enhance soil management and crop productivity. Traditional soil testing methods are often time-consuming and provide limited data. This study focuses on real-time soil nutrient assessment using IoT sensors and AI analytics. IoT-enabled sensors monitor key parameters such as nitrogen (N), phosphorus (P), potassium (K), pH, moisture, and temperature. The collected data is transmitted to a cloud platform, where AI algorithms analyze nutrient levels, identify imbalances, and predict potential deficiencies. Based on the analysis, the system provides fertilizer recommendations and alerts to optimize soil fertility and crop yield. This smart, data-driven approach reduces resource wastage, minimizes environmental impact, and supports sustainable, precision-based agriculture.

Key Words: *Digital Farming, Precision Agriculture, Soil Nutrient Assessment, IoT Sensors, Artificial Intelligence, AI Analytics, Smart Agriculture.*

END-TO-END AGRICULTURAL AUTOMATION: ENHANCING PRODUCTIVITY FROM SOIL TO HARVEST

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Abstract: Advancements in artificial intelligence (AI), the Internet of Things (IoT), and robotics are revolutionizing precision agriculture by enabling data-driven decision-making, efficient resource management, and sustainable farming practices. AI facilitates predictive analytics for yield forecasting, disease detection, and optimized planting schedules, while IoT-based sensor networks provide real-time data on soil health, weather conditions, and crop growth. Robotics introduces automation in seeding, harvesting, and soil testing, reducing labour dependency and enhancing operational efficiency. Collectively, these technologies improve productivity through precise water use, reduced fertilizer wastage, and better soil conservation. This paper discusses the integration of intelligent automation across all stages of farming—from soil preparation to harvesting—highlighting its potential to transform agriculture into a more efficient, resilient, and eco-friendly system.

Key Words: *Digital Farming, Precision Agriculture, Soil Nutrient Assessment, IoT Sensors, Artificial Intelligence, AI Analytics, Smart Agriculture.*

ENGINEERING AND FABRICATION OF A TRACTOR-DRAWN PLANTER FOR TURMERIC CULTIVATION

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Abstract: This study focuses on the design, engineering, and fabrication of a tractor-drawn planter specifically developed for turmeric cultivation. Traditional turmeric planting methods are labour-intensive, time-consuming, and often result in uneven spacing and inconsistent planting depth. The proposed planter is designed to overcome these limitations through a mechanical system that ensures uniform placement of turmeric rhizomes while maintaining optimal row spacing and depth. Fabrication utilizes locally available materials to minimize cost and enhance ease of maintenance. Field trials demonstrated significant improvements in planting precision, reduced labour requirements, and increased operational efficiency compared to manual methods. The machine's simple design, affordability, and adaptability make it suitable for small and medium-scale farmers, promoting mechanization in turmeric cultivation and supporting sustainable agricultural development.

Key Words: *Turmeric Cultivation, Tractor-Drawn Planter, Farm Mechanization, Precision Planting, Agricultural Engineering.*

ENGINEERING APPROACHES FOR CLIMATE-SMART AGRICULTURE

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Abstract: The rapid growth of the global population, coupled with the impacts of climate change and resource degradation, poses significant challenges to agricultural productivity and food security. Changing climatic conditions have led to increased temperature variability, irregular rainfall, and extreme weather events, all of which negatively affect crop yield, soil health, and farmer income. To sustain agricultural productivity and ensure food security, climate-smart agriculture (CSA) emphasizes practices that enhance resilience, improve resource efficiency, and reduce greenhouse gas emissions. Engineering approaches play a crucial role in implementing CSA through innovations in irrigation management, precision agriculture, renewable energy integration, protected cultivation, and farm mechanization. These technologies include sensor-based irrigation, solar-powered systems, climate-controlled environments, and AI-driven decision-support tools. Together, they enable efficient resource utilization and help farmers adapt to changing environmental conditions.

Key Words: *Climate-Smart Agriculture, Sustainable Development, Adaptation, Mitigation, Precision Farming, Agricultural Engineering.*

FUTURE OF FARM MECHANIZATION: INTELLIGENT SEEDING ROBOT FOR SMALL AND MARGINAL FARMERS – REVIEW

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Abstract: Farm mechanization is evolving rapidly with the integration of automation, robotics, and artificial intelligence (AI), particularly to support small and marginal farmers who often face labor shortages and high operational costs. Intelligent seeding robots represent a transformative innovation that can enhance sowing precision, reduce manual labor, and optimize resource use. Designed to be low-cost, energy-efficient, and adaptable to various field conditions, they enable uniform seed distribution and improved germination rates. The integration of IoT and GPS technologies allows for real-time monitoring and data-driven decision-making, ensuring consistent field performance and improved crop productivity. This review discusses current advancements in intelligent seeding systems, their design considerations, challenges in field implementation, and their potential to revolutionize small-scale farming by making mechanization more accessible and sustainable.

Keywords: *Intelligent Seeding Robot, Farm Mechanization, Small and Marginal Farmers, Precision Agriculture, Automation, IoT in Agriculture.*

IMPROVING TRANSPLANTING EFFICIENCY IN RICE THROUGH COMPACT MECHANIZED TRANSPLANTERS

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Abstract: Transplanting is a crucial stage in rice cultivation, directly affecting crop establishment, yield potential, and resource efficiency. Traditional manual transplanting methods are highly labor-intensive, time-consuming, and increasingly unsustainable due to declining agricultural labor availability. Compact mechanized rice transplanters have emerged as an efficient alternative to address these challenges, providing precision planting with reduced drudgery and improved productivity. These machines are lightweight, user-friendly, and designed to suit small and fragmented landholdings, making them ideal for smallholder farmers. Mechanized transplanting ensures uniform plant spacing, optimal seedling depth, and consistent hill population, which enhances tillering and overall yield. Additionally, it minimizes transplanting shock, promotes efficient water use, and enables timely operations, which are essential for sustainable rice production. The deployment of compact mechanized transplanters holds significant potential for enhancing labor efficiency, reducing costs, and promoting climate-resilient rice farming practices.

Key Words—*Rice Transplanting, Compact Transplanters, Mechanization, Labour Efficiency, Crop Establishment, Productivity.*

INTELLIGENT WATER-SMART FARMING USING AUTOMATION AND IoT-BASED IRRIGATION SCHEDULING

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Abstract—Water scarcity is one of the most pressing challenges in modern agriculture, demanding innovative approaches for efficient water utilization. Intelligent water-smart farming integrates automation and IoT-based technologies to optimize irrigation processes, ensuring that water is applied precisely when and where it is needed. This study presents an automated irrigation scheduling system that employs soil moisture, temperature, humidity, rainfall, and flow sensors connected to an ESP32 microcontroller for real-time monitoring and control. The system uses sensor feedback and predictive algorithms to determine irrigation timing and duration automatically, activating solenoid valves through wireless communication. The approach not only reduces labor dependency and human error but also promotes sustainability by minimizing water wastage and energy consumption. Future enhancements may include AI-driven analytics for adaptive irrigation scheduling and integration with weather forecasting systems.

Keywords— *Smart Irrigation, IoT Agriculture, Automated Scheduling, Soil Moisture Sensor, Water Efficiency, Embedded Systems, Sustainable Farming.*

IoT-ENABLED SMART FERTILIZATION FOR SUSTAINABLE AGRICULTURE

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Abstract: The growing global demand for food production has placed increasing pressure on agriculture to enhance productivity while maintaining environmental sustainability. Conventional fertilization methods often rely on generalized application techniques that lead to inefficient fertilizer use, soil nutrient imbalance, groundwater contamination, and increased production costs. This study presents an IoT-enabled smart fertilization system designed to optimize nutrient management in real time. The system integrates soil nutrient (NPK), moisture, and pH sensors along with environmental sensors for temperature and humidity, all connected to an ESP32/Arduino microcontroller. Data collected from the field is transmitted through Wi-Fi or LoRa communication to a cloud-based analytics platform, where algorithms determine precise fertilizer requirements. Moreover, the technology supports sustainability goals by reducing chemical runoff, minimizing greenhouse gas emissions, and conserving water resources.

Keywords: *Smart Fertilization, Precision Agriculture, Soil Nutrient Monitoring, Automated Fertilizer Injection, IoT in Farming, Sustainable Agriculture.*

IoT APPLICATIONS IN FARM MACHINERY: FROM SMART IRRIGATION TO AUTOMATED HARVESTING

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Abstract: The integration of the Internet of Things (IoT) in modern farm machinery is revolutionizing agriculture by transforming conventional practices into intelligent, connected, and data-driven operations. Among its key applications, smart irrigation stands out as a major innovation, where soil moisture, temperature, and weather sensors enable precise water management—applying water only when necessary, thus conserving resources and enhancing crop yield. Beyond irrigation, IoT technology empowers precision agriculture by optimizing seeding, fertilization, and pesticide application based on spatial and temporal variability within the field. This data-driven approach minimizes resource wastage, lowers operational costs, and promotes environmental sustainability. Nonetheless, IoT-driven farm mechanization holds immense potential to advance sustainable, productive, and resilient agricultural systems.

Keywords— Smart Irrigation, Precision Farming, Automated Harvesting, IoT Agriculture, Sustainable Farming, Data-Driven Agriculture.

IoT AS A GAME-CHANGER IN FARM OPERATIONS: SMART SOLUTIONS FOR IRRIGATION, WEEDING, AND MECHANIZED HARVESTING

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Abstract: The Internet of Things (IoT) has emerged as a transformative force in modern agriculture, enabling smart farm operations that are precise, efficient, and sustainable. By integrating sensors, communication networks, data analytics, and automated machinery, IoT technologies are revolutionizing traditional farming practices. This review explores how IoT applications are reshaping irrigation, weeding, and mechanized harvesting systems. It highlights recent technological advancements, implementation strategies, and the potential of IoT to address challenges such as water scarcity, labor shortages, and declining agricultural productivity. Furthermore, the article discusses limitations and future directions for large-scale adoption of IoT-enabled farm solutions.

Keywords— Internet of Things (IoT), Smart Irrigation, Automated Weeding, Mechanized Harvesting, Precision Agriculture, Sustainable Farming.

IOT-INTEGRATED FERTILIZATION TECHNIQUES FOR RESOURCE-EFFICIENT AGRICULTURE

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Abstract: This paper presents an IoT-integrated smart fertilization framework designed to enhance resource efficiency and sustainability in modern agriculture. The proposed system employs soil nutrient, moisture, and environmental sensors to collect real-time data, which is transmitted to a cloud-based platform for analysis. Using these insights, fertilizers are applied precisely based on crop requirements, minimizing waste and maximizing nutrient uptake efficiency. The system also includes a mobile interface that allows farmers to monitor soil health, receive fertilization recommendations, and control nutrient delivery remotely. Experimental implementations and field simulations demonstrate that the system significantly reduces fertilizer usage, enhances crop yield, and lowers operational costs. Furthermore, this approach contributes to environmental sustainability by reducing nutrient runoff and greenhouse gas emissions. The integration of IoT with precision fertilization practices paves the way for data-driven, intelligent, and resource-efficient agricultural systems.

Keywords: *IoT, Precision Agriculture, Smart Fertilization, Resource Efficiency, Soil Sensors, Sustainable Farming.*

IOT-BASED SMART SEEDING ROBOT FOR GROUNDNUT CULTIVATION

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Abstract: The IoT-Based Smart Seeding Robot for Groundnut Cultivation introduces an advanced automation solution aimed at improving the accuracy, efficiency, and productivity of the sowing process. Traditional manual seeding is labor-intensive, time-consuming, and inconsistent in terms of seed depth and spacing, leading to uneven germination and reduced yields. The proposed system employs a compact robotic platform equipped with a seed hopper, rotary dispensing unit, and depth control mechanism to ensure uniform seed placement. An ESP32 microcontroller powers the robot and manages real-time data from soil moisture, temperature, and ultrasonic sensors for optimized operation and obstacle detection. The robot's modular design—with transparent hoppers, LED indicators for seed drop confirmation, and easy-to-service components—makes it suitable for both agricultural applications and educational demonstrations. This innovation demonstrates how IoT and robotics can be effectively combined to promote precision farming, reduce human effort, and support sustainable groundnut cultivation.

Keywords: *IoT, Smart Seeding Robot, Groundnut Cultivation, Precision Agriculture, Automation.*

WASTE TO WEALTH: ADVANCING AGRICULTURE THROUGH INNOVATIVE RECYCLING AND REUSE TECHNOLOGIES – REVIEW

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Abstract: The transformation of agricultural waste into valuable resources has emerged as a critical strategy for achieving sustainability, reducing environmental burdens, and enhancing circular economies. Recent innovations in recycling and reuse technologies demonstrate significant potential for converting organic residues into biofertilizers, bioenergy, and biopolymers, thereby promoting resource efficiency in farming systems. For instance, composting and anaerobic digestion not only mitigate waste accumulation but also generate renewable energy and soil amendments that improve crop productivity (Reddy & Yang, 2005; Mohapatra et al., 2010). However, barriers such as high initial investment, lack of infrastructure, and limited farmer awareness remain challenges to large-scale adoption. This review provides an overview of the latest developments, current applications, and anticipated directions in recycling and reuse technologies for fostering sustainable agriculture through waste-to-wealth initiatives.

Key Words: Waste, Recycling, Resource Efficiency, Circular Economy, Sustainability.

TOWARDS SUSTAINABLE AGRICULTURE AUTOMATION IN IRRIGATION, NUTRIENT APPLICATIONS AND CROP MANAGEMENT – REVIEW

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Abstract: The rapid growth of global food demand, coupled with climate change and resource scarcity, has highlighted the need for sustainable agricultural practices. Automation in irrigation, nutrient application, and crop management has emerged as a transformative approach to enhance productivity while conserving natural resources. Smart irrigation systems driven by sensors and artificial intelligence optimize water use efficiency, minimizing wastage and improving crop yields. Similarly, advanced crop management techniques, including automated monitoring, robotics, and decision-support systems, facilitate timely interventions and reduce labor dependency. Integrating these automation technologies within sustainable agriculture frameworks promotes resilience, reduces input costs, and fosters eco-friendly farming. This review highlights the technological innovations, challenges, and future prospects of agricultural automation, emphasizing its pivotal role in achieving long-term food security and environmental sustainability.

Key Words: Sustainable Agriculture, Automation, Smart Irrigation, Crop Monitoring, Robotics.

THE DESIGN OF ROBOBEES FOR AGRICULTURAL INNOVATION – THE FUTURE OF POLLINATION

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Abstract: Pollination is a critical ecosystem service that directly influences global food security. However, the decline of natural pollinators such as bees, due to climate change, habitat loss, and pesticide use, poses a major challenge to sustainable agriculture. In this context, Robobees—miniature robotic pollinators—offer a futuristic and technologically driven solution to supplement or replace natural pollination in critical scenarios. This paper explores the design, engineering principles, and potential applications of Robobees in agriculture. Preliminary simulations and prototypes demonstrate promising outcomes in terms of flight stability, precision landing, and pollen transfer efficiency. Beyond pollination, Robobees hold potential applications in crop monitoring, precision spraying, and environmental data collection. While challenges such as energy storage, large-scale deployment, and ecological ethics remain, Robobees signify a transformative step towards sustainable and resilient agricultural innovation.

Key Words: *Robobees, Agricultural Robotics, Artificial Pollination, Sustainable Farming, Precision Agriculture.*

SUSTAINABLE MECHANIZATION FOR RESOURCE-EFFICIENT FARMING

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Abstract— Agriculture remains a critical pillar for food security, employment, and economic development. However, modern agriculture faces significant challenges including declining soil fertility, water scarcity, and labor shortages. Sustainable agricultural mechanization (SAM) presents a viable solution to address these issues by promoting energy-efficient and environmentally responsible technologies in farming. This paper discusses the current state of farm mechanization in India, highlighting regional disparities and the need for location-specific strategies. It explores the concept of SAM and outlines its major benefits, such as improved input efficiency, optimized water usage, and reduced dependency on manual labor. The integration of precision agriculture tools and renewable energy systems further strengthens the potential of SAM to contribute to sustainable and resilient agricultural systems.

Key Words— *Sustainable agricultural mechanization, farm mechanization, precision agriculture.*

SMART AGRICULTURE: INTEGRATING AI AND DRONE TECHNOLOGY FOR SEED INSPECTION

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Abstract— Agriculture today faces heightened challenges from climate change, growing population, labor shortages, and the need for sustainable resource use. Traditional farming practices, including manual seed inspection, are increasingly inadequate to meet these demands. Manual seed inspection is labor-intensive, time-consuming, and often lacks accuracy, which can impact crop yields and quality. This pressing need for innovation has spurred the adoption of smart agriculture technologies that leverage digital tools to improve productivity and sustainability. Smart agriculture integrates modern technologies such as artificial intelligence (AI) and drones to create data-driven, precise farming systems. The integration of these technologies enables farmers to optimize inputs, reduce wastage, detect problems early, and make informed decisions that maximize both yield and environmental health.

Key Words— Climate change, growing population, labor shortages, seed inspection.

RENEWABLE ENERGY INTEGRATION IN AGRICULTURAL SYSTEMS

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Abstract— In the article the authors explore the critical intersection between renewable energy integration and agricultural practices to address the pressing need for sustainability in the farming industry. With the agricultural sector being a significant consumer of energy and a contributor to greenhouse gas emissions, the article emphasizes the potential of renewable energy sources—such as solar, wind, biomass, and geothermal energy—to not only reduce carbon footprints but also to enhance the economic viability of farms. The paper highlights case studies and real-world examples where renewable energy projects have been successfully implemented on farms, demonstrating improvements in energy efficiency, cost savings, and resilience against fluctuating energy prices. The article concludes by emphasizing the role of innovation and policy support in scaling up renewable energy use in the sector, thereby contributing to a more sustainable and environmentally friendly agricultural future.

Key Words— Climate change, growing population, labor shortages, seed inspection.

RECENT ADVANCES IN DRIVERLESS TRACTORS AND AUTONOMOUS FARM VEHICLES

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Abstract: This article explores the recent advancements in driverless tractors and autonomous farm vehicles, highlighting their transformative impact on modern agricultural systems. With increasing demands for productivity, sustainability, and labor efficiency, autonomous machinery is rapidly replacing conventional manually operated equipment. These advanced systems integrate high-accuracy GNSS, LiDAR, multi-camera computer vision, and AI-powered onboard processing to enable precise navigation, obstacle detection, and intelligent field task management. Commercial and research-based innovations are supported by lightweight communication protocols, decentralized control systems, and mission planning frameworks that have been validated in both lab and field settings. The study further reflects on the increasing involvement of OEMs and startups in deploying autonomous solutions, backed by significant investments and favorable market forecasts.

Key Words— *Driverless tractors, autonomous vehicles, GNSS, swarm robotics, retrofit kits, smart farming.*

PRECISION PLANTING OF CASSAVA USING A SEMI-AUTOMATIC PLANTER

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Abstract: Cassava (*Manihot esculenta* Crantz) is a key tropical root crop vital to food security, industrial processing, and rural economies. Traditional planting practices, often reliant on manual labor, result in irregular plant spacing, variable depth, and reduced planting efficiency. To address these limitations, this study presents the development and field evaluation of a semi-automatic cassava planter aimed at improving precision in planting operations. The proposed semi-automatic planter incorporates a controlled metering and guiding system that ensures consistent placement of stem cuttings at optimal depth and spacing. The integration of this semi-automated technology into cassava cultivation practices offers multiple benefits, including reduced labor costs, improved yield uniformity, and a step toward mechanized and sustainable cassava farming. The study underscores the potential of precision planting technologies in advancing agricultural productivity and promoting sustainable intensification in root crop production systems.

Key Words— *Precision planting, cassava, semi-automatic planter, mechanization, crop establishment, sustainable agriculture.*

PRECISION AGRICULTURE THROUGH SMART GIS: OPTIMIZING FARM PRODUCTIVITY AND SUSTAINABILITY

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Abstract: Precision agriculture is revolutionizing the agricultural landscape by enabling site-specific, data-driven management practices that significantly improve both productivity and sustainability. At the forefront of this transformation is Smart Geographic Information Systems (GIS), which serve as a powerful tool for optimizing farm operations through spatial analysis and integrated data management. Smart GIS combines spatial and temporal data from diverse sources, including soil sensors, satellite imagery, weather stations, and IoT-based field devices, to deliver comprehensive insights into field variability. These insights enable farmers to implement targeted interventions such as variable-rate irrigation, fertilizer application, and pest control, based on real-time data and specific crop requirements.

Key Words— Precision Agriculture, Smart GIS, Farm Productivity, Spatial Analysis, Sustainability.

IOT-ENABLED SMART FARMING: INTEGRATING IRRIGATION, FERTILIZATION, WEEDING, AND HARVESTING SYSTEMS

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Abstract: The agricultural sector faces increasing challenges in balancing productivity, resource efficiency, and sustainability. The Internet of Things (IoT) offers transformative potential by enabling automation, real-time data collection, and intelligent decision-making. This paper presents an IoT-enabled smart farming system that integrates four core agricultural operations—irrigation, fertilization, weeding, and harvesting—into a unified, automated framework. The system utilizes soil moisture sensors, nutrient analyzers, imaging devices, and crop maturity indicators to continuously gather and process field data through cloud-based analytics platforms. Preliminary analyses suggest notable reductions in water and fertilizer use and increased overall operational efficiency. This holistic IoT-driven model demonstrates the potential of merging multiple farm operations under a single intelligent framework, paving the way for scalable, sustainable, and data-driven agriculture.

Keywords: IoT-enabled agriculture, Smart farming systems, Precision agriculture, Automated irrigation, Fertilization, Weeding, Harvesting.

LASER WEEDING TECHNOLOGY: A SUSTAINABLE APPROACH FOR PRECISION WEED MANAGEMENT

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Abstract: Traditional weed management techniques, which rely heavily on herbicides and mechanical tillage, are increasingly challenged by herbicide resistance, environmental degradation, and rising labour costs. To overcome these limitations, laser weeding technology has emerged as a sustainable, non-chemical alternative that leverages precision and automation. This advanced system integrates machine vision, artificial intelligence (AI), and high-powered laser modules to detect and eliminate weeds autonomously with pinpoint accuracy. Despite its advantages, challenges such as high energy demand, limited field speed, and initial setup costs remain. Ongoing research continues to address these issues, aiming to enhance efficiency, scalability, and affordability. Overall, laser weeding represents a transformative step toward intelligent, eco-friendly, and precise weed control, contributing to higher productivity and long-term agricultural sustainability.

Keywords: *Laser weeding, Precision agriculture, Sustainable farming, Artificial intelligence, Weed management.*

MODERN POWER WEEDERS AND THEIR ROLE IN SUSTAINABLE CROP PRODUCTION – REVIEW

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Abstract: Weeding is one of the most labour-intensive operations in agriculture, directly influencing crop yield and sustainability. The introduction of modern power weeders has revolutionized weed management by providing an efficient, precise, and labour-saving alternative to traditional manual and animal-drawn methods. Available in various designs—such as self-propelled, tractor-mounted, and mini-weeders—these machines are adaptable to diverse crop types and field conditions. Despite their benefits, widespread adoption among smallholder farmers remains limited due to high initial investment costs, inadequate training, and low awareness of mechanized weeding solutions. This review discusses the evolution, classification, and technological advancements of modern power weeders, highlighting their critical role in achieving sustainable crop production while identifying challenges and future directions for their effective implementation.

Keywords: *Weed management, Power weeders, Sustainable agriculture, Mechanization, Crop productivity.*

INTERNET OF THINGS IN AGRICULTURE: AUTOMATED WEED DETECTION AND CONTROL SYSTEMS

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Abstract: The integration of the Internet of Things (IoT) into agriculture has revolutionized conventional farming by enabling real-time monitoring, automation, and data-driven decision-making. Among its many applications, automated weed detection and control systems have emerged as a key innovation to overcome challenges such as yield loss, excessive herbicide dependence, and high labour requirements. This approach promotes sustainable farming by minimizing environmental pollution, conserving resources, and enhancing crop productivity. The paper discusses the architecture, working principles, and advantages of IoT-based weed control systems, emphasizing their role in advancing precision agriculture and contributing to global food security.

Keywords: IoT, Smart Agriculture, Automated Weed Detection, Precision Farming, Computer Vision, Machine Learning, UAVs, Sustainability, Crop Yield Optimization.

OPTIMIZING NUTRIENT MANAGEMENT THROUGH IOT-ENABLED FERTILIZER APPLICATION

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Abstract: Efficient nutrient management is vital for improving crop productivity, minimizing input wastage, and mitigating environmental degradation in modern agriculture. Conventional fertilizer application methods often result in overuse or uneven distribution, leading to soil nutrient imbalance, leaching, and reduced yield efficiency. This paper presents an Internet of Things (IoT)-enabled smart fertilization framework designed to deliver precise, real-time nutrient management. Data is transmitted to a cloud-based dashboard, where analytical algorithms assess soil fertility trends and guide fertilizer dosing. By integrating automation with data analytics, the system ensures optimal nutrient delivery, improved fertilizer-use efficiency, and reduced environmental impact. Field evaluation demonstrates improved crop health and a significant reduction in fertilizer consumption. The research underscores IoT's transformative potential in achieving sustainable, data-driven, and resource-efficient agriculture.

Keywords— IoT in Agriculture, Precision Farming, Smart Fertilizer Application, Nutrient Management, Soil Health Monitoring, Sustainable Agriculture, Site-Specific Crop Management, Fertilizer Optimization.

NEXT-GENERATION IOT APPLICATIONS IN IRRIGATION AND CROP MANAGEMENT

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Abstract: The agricultural sector faces pressing challenges due to climate change, water scarcity, population growth, and the need for sustainable food production. Next-generation Internet of Things (IoT) technologies have emerged as a transformative solution for precision irrigation and crop management. By integrating low-power wide-area networks (LPWAN), edge and cloud computing, artificial intelligence (AI), blockchain, and big data analytics, IoT enables real-time sensing, decision-making, and autonomous control of agricultural resources. This paper presents a comprehensive review of next-generation IoT applications in irrigation and crop management. It examines system architectures, enabling technologies, and case studies, highlighting their role in enhancing productivity, resource efficiency, and sustainability. Furthermore, it identifies challenges related to scalability, interoperability, data security, and energy management. Finally, future research directions are discussed, with emphasis on 6G-driven IoT, swarm robotics, and digital twin models for predictive agriculture.

Keywords: *IoT, smart irrigation, crop management, precision agriculture, edge computing, sustainable farming*

TECHNOLOGICAL ADVANCEMENTS IN SUGARCANE HARVESTING: DEVELOPMENT OF A MINI COMBINE HARVESTER

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Abstract— Sugarcane is a high-demand cash crop in India, yet its harvesting continues to rely heavily on manual labor, leading to delays, higher costs, and reduced efficiency. With growing labor shortages and the need for precision farming, the development of a mini combine harvester presents a sustainable solution for small and medium-scale farmers. This paper explores the integration of mechanical innovation with artificial intelligence (AI) and machine learning (ML) to design a compact, cost-effective, and efficient harvesting system. IoT-based sensors enhance operational precision by monitoring soil conditions, field slope, and crop density, allowing real-time decision-making. Machine learning algorithms further optimize fuel consumption, blade speed, and harvesting routes to minimize energy usage and operational costs. The research emphasizes the role of computing power in predictive maintenance, enabling farmers to monitor equipment health and reduce downtime. By combining AI, automation, and engineering design, this innovation directly addresses challenges in sugarcane harvesting, improves efficiency, and ensures long-term sustainability in Indian agriculture. The proposed model not only bridges the technology gap for small-scale farmers but also paves the way for smart mechanization in the agri-sector, contributing to food security and rural development in the era of Industry 4.0.

Keywords— *Sugarcane , harvesting, combine harvester.*

TOWARDS SUSTAINABLE AGRICULTURE AUTOMATION IN IRRIGATION, NUTRIENT APPLICATIONS AND CROP MANAGEMENT

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Abstract:

Sustainable agriculture requires efficient utilization of water, nutrients, and energy resources while ensuring optimal crop productivity. This project focuses on developing an integrated automation system that combines IoT (Internet of Things), AI-based decision support, and sensor technologies to enhance irrigation, nutrient application, and crop management. Soil moisture, temperature, and nutrient sensors are deployed to monitor field conditions in real time. The collected data are processed through AI algorithms to determine the precise amount of water and fertilizer required, minimizing wastage and environmental impact. Automated control units manage irrigation valves and nutrient delivery systems based on these intelligent recommendations. The system also incorporates crop health monitoring using image analysis and predictive modeling to support timely interventions. By integrating automation and smart analytics, this project aims to promote resource efficiency, reduce manual labor, and contribute to the long-term sustainability of agricultural practices.

DESIGN OF MULTICROP SEEDING ROBOT WITH AI CONTROL FOR CEREAL AND OILSEED

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Abstract: The increasing demand for precision and efficiency in agricultural operations has led to the development of intelligent and automated seeding systems. This project presents the design and development of a multicrop seeding robot equipped with AI-based control for the sowing of cereal and oilseed crops. The system integrates machine vision, soil sensors, and GPS navigation to achieve accurate seed placement, uniform depth, and optimal spacing. The AI module identifies soil conditions and crop types, adjusting the seeding rate and pattern accordingly. The robot employs a microcontroller-based drive mechanism for precise movement and seed dispensing, minimizing seed wastage and labor dependency. Real-time monitoring and data collection enhance operational efficiency and support decision-making for future planting cycles. This AI-controlled multicrop seeding robot offers a sustainable, cost-effective solution for modern agriculture, promoting productivity and precision in crop establishment.

SMART MECHANIZATION STRATEGIES FOR SUSTAINABLE AND RESOURCE-EFFICIENT FARMING

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Abstract: Modern agriculture faces the challenge of increasing productivity while conserving natural resources and minimizing environmental impact. This project focuses on the development and implementation of sustainable mechanization practices aimed at achieving resource-efficient farming. The proposed system integrates smart sensors, IoT-based monitoring, and data-driven decision-making to optimize the use of water, fuel, and fertilizers. Mechanized operations such as tillage, planting, and irrigation are automated and precisely controlled to reduce resource wastage and enhance field efficiency. Renewable energy sources, such as solar-powered systems, are incorporated to ensure eco-friendly operation. By combining advanced machinery with intelligent control and real-time feedback, the project promotes sustainable agricultural practices that reduce labor dependency, improve soil health, and enhance long-term farm productivity. This approach represents a step toward a resilient and technologically empowered agricultural future.

APPLICATION OF MACHINE LEARNING MODELS FOR YIELD PREDICTION IN PRECISION AGRICULTURE

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Abstract: Predicting crop yield with accuracy is crucial for optimizing resource allocation, planning harvest schedules, and ensuring food security. Traditional yield estimation methods are often inaccurate due to their inability to integrate diverse variables. This study applies advanced machine learning (ML) models to predict wheat yield using multiple parameters, including soil fertility, rainfall, temperature, management practices, and remote sensing data. Three ML algorithms—Random Forest (RF), Support Vector Machine (SVM), and Artificial Neural Networks (ANN)—were trained on multi-year datasets collected from experimental plots and open-access agricultural databases. Among the models, Random Forest achieved the highest accuracy with $R^2 = 0.89$, $RMSE = 0.72$, outperforming both SVM and ANN. The RF model demonstrated strong robustness in handling nonlinear interactions between environmental and management factors.

Keywords: Precision agriculture, yield prediction, machine learning, Random Forest, SVM, wheat

ARTIFICIAL INTELLIGENCE AND SENSOR NETWORKS FOR WEED DETECTION AND MANAGEMENT IN PRECISION AGRICULTURE

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Abstract: Weed infestation is a major constraint in crop production, causing significant yield losses and increasing the cost of cultivation due to manual and chemical control practices. Traditional weed management often relies on blanket herbicide applications, which are costly, environmentally harmful, and may lead to herbicide resistance. In this study, AI-driven image recognition algorithms were trained on drone and field camera datasets to distinguish between crop plants and weed species in wheat fields. Convolutional Neural Networks (CNNs) achieved a classification accuracy of 92%, enabling precise mapping of weed-infested zones. IoT-enabled sensor nodes further monitored soil and crop conditions to optimize herbicide application. The integrated system facilitated variable-rate spraying, which reduced herbicide usage by 28% and minimized environmental pollution. Additionally, crop yield improved by 9% due to reduced competition from weeds. This research underlines the potential of smart technologies in developing automated weed control systems as part of next-generation precision agriculture.

Keywords: Precision agriculture, artificial intelligence, sensor networks, weed detection, CNN, site-specific management

AUTONOMOUS MACHINERY AND ROBOTICS

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Abstract: The advancement of autonomous machinery and robotics is reshaping modern agriculture and industry by reducing dependence on manual labor and enhancing precision, efficiency and sustainability. Through the integration of AI, sensors, and automation technologies, machines are now capable of operating independently and adapting to complex environments. Within this domain, swarm robotics stands out as a revolutionary approach inspired by the collective behavior of ants, bees, and other social species. Instead of relying on a single machine, swarms function as a network of small, intelligent robots that communicate, self-organize, and collaborate to accomplish large-scale tasks. In agriculture, these systems enable precision seeding, targeted weeding, monitoring, and harvesting with improved speed and reduced sustainable automation with swarm intelligence, a new era of scalable, resilient, and sustainable automation is emerging, paving the way for smarter and greener innovations in the future.

Keywords: AI, sensors, autonomous machinery and robotics

BIG DATA AND DECISION SUPPORT SYSTEMS FOR SMART FARM MANAGEMENT IN PRECISION AGRICULTURE

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Abstract: The agricultural sector generates vast amounts of data through sensors, satellites, farm machinery, and weather monitoring systems. However, the challenge lies in analyzing and converting this data into actionable insights for farmers. This paper presents a big data-driven Decision Support System (DSS) framework for smart farm management in soybean cultivation. The DSS integrates heterogeneous data sources, including soil fertility maps, historical weather data, real-time IoT sensor inputs, and remote sensing imagery. Big data analytics techniques such as clustering and regression modeling were applied to identify patterns in crop growth and predict input requirements. Case studies revealed that the DSS reduced fertilizer and pesticide usage by 15% while increasing soybean yield by 10%. The system also provided predictive insights on pest outbreaks and optimal irrigation schedules, enabling timely interventions. By bridging data collection and practical farm management, the DSS empowers farmers with knowledge-based decision-making, leading to higher profitability and sustainability. The study concludes that big data analytics, when integrated into precision agriculture, has the potential to revolutionize farming by making it more adaptive, efficient, and environmentally sustainable.

Keywords: Precision agriculture, big data, decision support system, smart farming, soybean

INTEGRATION OF IOT AND GIS FOR PRECISION NUTRIENT MANAGEMENT IN RICE CULTIVATION

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Abstract: Nutrient management is one of the most critical challenges in intensive rice farming systems, where excessive and imbalanced fertilizer use not only raises production costs but also leads to soil degradation and environmental hazards. Precision agriculture offers site-specific nutrient application strategies by utilizing advanced technologies. In this study, IoT-enabled soil sensors were deployed across rice-growing fields to continuously monitor soil pH, nitrogen, phosphorus, potassium, and moisture content. Results indicated an 18% reduction in chemical fertilizer input without compromising yield, and overall productivity improved by 12%. Additionally, nutrient use efficiency was significantly enhanced, leading to reduced input costs and improved soil health. The findings demonstrate that combining IoT and GIS technologies can transform nutrient management practices in rice farming, making them more sustainable, environmentally friendly, and farmer-centric. This integrated approach not only improves productivity but also supports the goals of sustainable agriculture and climate-smart farming practices.

Keywords: Precision agriculture, IoT, GIS, nutrient management, rice cultivation, sustainability

VARIABLE RATE IRRIGATION USING SOIL MOISTURE SENSORS AND IOT IN PRECISION FARMING

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Abstract: Water scarcity is an emerging challenge in modern agriculture, particularly in water-intensive crops like sugarcane. Precision irrigation techniques such as Variable Rate Irrigation (VRI) have shown promise in optimizing water use efficiency while maintaining crop productivity. In this study, IoT-enabled soil moisture sensors were strategically placed across fields to record real-time soil water content at multiple depths. GIS mapping was used to classify zones within the field that required different irrigation levels. Field experiments demonstrated that VRI reduced water consumption by 20–25% compared to conventional uniform irrigation, with no significant reduction in yield. In fact, the enhanced water distribution improved root development and increased sugar recovery by 8%. Furthermore, energy savings were achieved due to reduced pumping hours. This research highlights how precision irrigation, supported by IoT technologies, not only conserves water but also reduces input costs and greenhouse gas emissions associated with irrigation practices. The adoption of VRI systems could play a key role in promoting climate-smart agriculture in regions facing water scarcity challenges.

Keywords: Precision irrigation, IoT, soil moisture sensors, water use efficiency, sugarcane

DEVELOPMENT AND APPLICATION OF SOIL MOISTURE SENSORS FOR PRECISION AGRICULTURE

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Abstract: Efficient water management is a cornerstone of sustainable agriculture, especially under the growing pressures of climate change and water scarcity. Traditional irrigation practices often lead to under- or over-irrigation, affecting both crop yield and resource use efficiency. Soil moisture sensors provide real-time data on soil water status, enabling farmers to optimize irrigation scheduling and adopt precision agriculture practices. This paper discusses the design, working principles, and field applications of soil moisture sensors, focusing on both resistive (gypsum blocks, tensiometers) and advanced electronic sensors (capacitance, TDR, and FDR-based). The study highlights the integration of soil moisture sensors with IoT-enabled smart irrigation systems, which allow remote monitoring and automated control of irrigation. Field trials demonstrate significant improvements in water use efficiency (up to 30–40%), reduction in labour, and enhanced crop performance.

Keywords Soil moisture sensor, precision irrigation, water use efficiency, smart farming, IoT in agriculture, sustainable water management

DEVELOPMENT AND PERFORMANCE EVALUATION OF A MINI SUGARCANE COMBINE HARVESTER FOR SMALLHOLDER FARMING SYSTEMS

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Abstract: Sugarcane harvesting is traditionally labour-intensive, time-consuming, and costly, especially in regions where farm holdings are small and fragmented. Conventional large-scale sugarcane combine harvesters, though highly efficient, are not economically viable or suitable for narrow fields and smallholder farms. To address this challenge, a mini sugarcane combine harvester was designed and evaluated for its technical feasibility and field performance. The developed machine integrates multiple operations such as base cutting, feeding, chopping into billets, leaf stripping, cleaning, and loading in a single pass. Powered by a compact diesel engine (40–80 hp range), the harvester is engineered to operate effectively in row spacing of 90–120 cm, common in Indian sugarcane cultivation systems. Field trials demonstrated its capacity to harvest 0.25–0.40 hectares per hour, with reduced cane loss (<5%) and improved billet uniformity, ensuring higher milling efficiency.

Keywords: Sugarcane harvesting, mini combine harvester, mechanization, billet quality, smallholder farming, labour-saving technology

AUTONOMOUS MACHINERY IN AGRICULTURE: ADVANCING PRECISION AND SUSTAINABILITY

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Abstract: Automation in agriculture has emerged as a pivotal innovation, bridging the gap between rising global food demands and the limitations of conventional farming practices. Unlike traditional mechanization, which primarily aimed at reducing manual drudgery, modern automation integrates robotics, artificial intelligence (AI), sensor technologies, and the Internet of Things (IoT) to create intelligent, interconnected farming systems. These technologies enable real-time monitoring of soil, crops, and livestock, while also facilitating autonomous operations such as seeding, irrigation, spraying, weeding, and harvesting. Automation not only enhances productivity and operational efficiency but also ensures precision in input use, resulting in reduced costs and minimized environmental footprints. Applications extend to livestock management through robotic milking and feeding systems, as well as post-harvest operations involving AI-based sorting and grading. Despite its immense potential, adoption is challenged by high capital investments, technical complexities, limited infrastructure in rural areas, and the need for specialized farmer training.

Keywords: Automation in agriculture, agricultural robotics, precision farming, AI in agriculture, sustainable farming

DESIGN AND DEVELOPMENT OF SPINACH HARVESTER

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Abstract: The project focuses on the fabrication of a semi-automated spinach harvesting machine designed to reduce manual labor and increase efficiency. The machine operates using a DC motor powered by a rechargeable battery. A chain drive mechanism, in combination with wheels and spur gears, drives the cutting and movement system. The cutter mechanism is positioned to trim spinach just above the root level, ensuring clean cuts. This low-cost, portable, and eco-friendly machine is suitable for small-scale farmers. It aims to enhance productivity, reduce fatigue, and minimize time spent during harvesting, offering a practical solution to labor shortages in agriculture.

Keywords: Spinach, Harvester, Mechanization, Efficiency, Leafy vegetables, Agriculture.

DEVELOPMENT OF SMART MINI CARROT HARVESTER FOR SMALL SCALE FARMER

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Abstract: The proposed project focuses on the development of a smart mini carrot harvester for small-scale farmers, designed to reduce manual effort and increase harvesting efficiency. The harvester operates using a motor-driven mechanism, where a sharp edge rod first loosens the soil around the carrot roots to minimize resistance during extraction. Following this, a V-shaped blade lifts the loosened carrots from the ground, ensuring minimal crop damage and effective pulling. The harvested carrots are then directed toward a simple collection system for easy handling. This compact and affordable design is aimed at addressing the challenges faced by small and marginal farmers, providing them with a low-cost, labor-saving, and time-efficient solution for carrot harvesting. The machine can potentially be modified to handle similar root vegetables such as radish, beetroot, and turnip with minimal changes to the blade geometry, making it versatile. One of the key advantages of this design lies in its simplicity and adaptability.

Keywords: Banana leaf residue, Biodegradable Switchboard, Real time monitoring, Sustainable

HARNESSING GREEN NANOTECHNOLOGY TO CONVERT AGRICULTURAL RESIDUES INTO SUSTAINABLE NANO FERTILIZERS

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Abstract: The excessive use of chemical fertilizers has led to soil degradation, low nutrient-use efficiency, and environmental pollution. To overcome these limitations, the development of organic nano fertilizers derived from agricultural waste offers a sustainable solution. In this research, nutrient-rich residues, including rice husks, sugarcane bagasse, fruit peels, and animal manures, were processed through bioconversion techniques integrated with green nanotechnology approaches. Unlike conventional fertilizers, these organic nano fertilizers provide a slow and steady release of nutrients, supporting precision farming practices. Preliminary soil incubation and plant growth studies revealed improvements in soil fertility, microbial activity, crop yield, and overall resource efficiency. Additionally, converting agricultural waste into value-added nanoproducts supports a circular bioeconomy by reducing waste disposal issues and minimizing greenhouse gas emissions.

KEYWORDS: Organic nano fertilizers, Agricultural waste, Controlled nutrient release, Sustainable agriculture

DRONE-ENABLED DATA-DRIVEN SOLUTIONS FOR SUSTAINABLE AGRICULTURE

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Abstract: Sustainable agriculture demands innovative solutions that optimize resource utilization while minimizing environmental impact. This paper presents a drone-enabled, data-driven framework for improving agricultural productivity and sustainability. Unmanned Aerial Vehicles (UAVs) equipped with multispectral and thermal imaging sensors are deployed to collect high-resolution field data in real time. The acquired data is processed using advanced analytics and machine learning algorithms to generate actionable insights on crop health, soil moisture, pest infestation, and nutrient distribution. These insights are further integrated into decision-support systems that guide precision farming practices such as targeted irrigation, optimized fertilizer application, and timely pest control. By enabling farmers to make informed decisions, the proposed system reduces input costs, enhances yield quality, and supports long-term environmental conservation.

Keywords: Unmanned Aerial Vehicles (UAVs), multispectral and thermal imaging sensors

JOYSTICK-OPERATED AUTONOMOUS SPRAYER BOT FOR PRECISION CROP PROTECTION

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Abstract: In modern agriculture, the demand for efficient, safe, and precise spraying systems is increasing due to rising labor shortages and the need to minimize chemical exposure. This project presents the design and development of a Joystick-Operated Autonomous Sprayer Bot, aimed at achieving precision crop protection through smart mechanization. The bot integrates a microcontroller-based control system that enables manual operation via a joystick and semi-autonomous movement through ultrasonic sensors for obstacle detection. It ensures uniform pesticide application and reduces wastage by maintaining a consistent spray rate and coverage. The mechanical structure is designed in SolidWorks, optimizing stability, maneuverability, and weight distribution. An IoT module is incorporated to monitor spray parameters and operational efficiency in real time. This innovation not only enhances field efficiency and worker safety but also contributes to sustainable farming practices by optimizing chemical use.

Keywords: *Sprayer Bot; Joystick Control; Precision Farming; Automation; IoT; Robotics; Sustainable Agriculture*

VARIABLE RATE IRRIGATION USING SOIL MOISTURE SENSORS AND IOT IN PRECISION FARMING

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Abstract: Water scarcity is an emerging challenge in modern agriculture, particularly in water-intensive crops like sugarcane. Precision irrigation techniques such as Variable Rate Irrigation (VRI) have shown promise in optimizing water use efficiency while maintaining crop productivity. In this study, IoT-enabled soil moisture sensors were strategically placed across fields to record real-time soil water content at multiple depths. These data were transmitted to a central controller, which activated automated irrigation systems based on zone-specific thresholds. GIS mapping was used to classify zones within the field that required different irrigation levels. Field experiments demonstrated that VRI reduced water consumption by 20–25% compared to conventional uniform irrigation, with no significant reduction in yield. In fact, the enhanced water distribution improved root development and increased sugar recovery by 8%. Furthermore, energy savings were achieved due to reduced pumping hours.

Keywords: *Precision irrigation, IoT, soil moisture sensors, water use efficiency, sugarcane*

AI-POWERED ENERGY MANAGEMENT SYSTEM

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ABSTRACT: This project proposes the development of an AI-powered energy management system tailored for industrial and commercial applications. With rising energy costs and increased environmental concerns, efficient energy utilization has become critical. Our system will leverage real-time data collection through IoT sensors, machine learning algorithms for energy forecasting, and automated control mechanisms to optimize energy consumption. This intelligent solution is designed to reduce energy wastage, lower operational costs, and minimize environmental impact. The innovation lies in the system's ability to learn and adapt to dynamic energy usage patterns, enabling predictive and autonomous decision-making. The project aligns with sustainable development goals and offers a scalable framework for smart infrastructure transformation.

Keywords: *IoT sensors, machine learning, algorithms for energy forecasting, automated control mechanisms.*

SMART MOBILE ROVER WITH REAL-TIME CROP DATA, AI –PEST DETECTION, HARVEST SCHEDULING, IRRIGATION SCHEDULING

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ABSTRACT: This project introduces a smart, AI-integrated agricultural system aimed at supporting small and marginal farmers in crop monitoring, pest detection, irrigation scheduling, and harvest prediction. Utilizing an ESP32-CAM and environmental sensors, the system captures field data and applies image-based AI models to identify pests and assess crop ripeness. All data is displayed on a user-friendly mobile dashboard featuring weather updates, soil metrics, a crop calendar, and government scheme information. The system includes a multilingual chatbot with Tamil and English support, enhancing accessibility and usability. This solution promotes precision agriculture, digital transformation, and sustainable farming through affordable, scalable technology.

Keywords : *Mobile Rover, Real-Time Crop Data, Ai –Pest Detection, Harvest Scheduling, Irrigation Scheduling.*

DEVELOPMENT OF CITRUS PEEL BASED EDIBLE COATING FOR EXTENDING SHELF LIFE OF CLIMATERIC FRUITS

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ABSTRACT: Postharvest losses of climacteric fruits such as bananas, mangoes, and tomatoes are a major challenge due to their rapid ripening and high perishability. The present study focuses on the development of an eco-friendly, citrus peel-based edible coating aimed at extending the shelf life and maintaining the quality of these fruits during storage. Citrus peels, a rich source of natural antioxidants, flavonoids, and essential oils, were utilized to formulate a bioactive coating solution using biodegradable polymers such as chitosan and starch. The coating was applied to selected climacteric fruits and evaluated for its effect on physiological weight loss, firmness, color retention, respiration rate, and microbial growth over a defined storage period. Results revealed that the citrus peel-based coating significantly reduced respiration rate and delayed ripening compared to uncoated controls. Furthermore, sensory and biochemical analyses indicated improved retention of nutritional quality and extended marketable life.

Keywords: Citrus peel extract, edible coating, climacteric fruits, postharvest preservation, shelf-life extension, biodegradable polymers, natural antioxidants, food waste reduction.

DATA-DRIVEN PEST AND DISEASE MANAGEMENT IN CONTROLLED ENVIRONMENTS

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Abstract: Data-driven pest and disease management in controlled environments has emerged as a transformative approach to ensuring sustainable and efficient crop production. By integrating advanced sensing technologies, Internet of Things (IoT) devices, and artificial intelligence (AI)-based analytics, growers can continuously monitor critical environmental parameters such as temperature, humidity, and soil moisture, alongside real-time detection of pest and pathogen activity. Machine learning models enable early prediction and diagnosis of infestations by analyzing image data, sensor readings, and historical records, thereby facilitating timely and precise interventions. This approach minimizes the overuse of pesticides, reduces crop losses, and promotes eco-friendly cultivation practices. Moreover, data visualization and decision-support systems enhance farmers' ability to make informed management choices under dynamic greenhouse or vertical farming conditions. Overall, data-driven strategies represent a paradigm shift from reactive to predictive plant protection, fostering both productivity and environmental sustainability in controlled agricultural systems.

Keywords— Data-driven agriculture, Pest management, Disease detection, Controlled environment, IoT, Machine learning, Precision farming, Smart greenhouse

THE DESIGN AND DEVELOPMENT OF A MULTI-CROP SEEDING ROBOT WITH AI CONTROL

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ABSTRACT: The Design and Development of a Multi-Crop Seeding Robot with AI Control focuses on automating the crop seeding process to improve precision, efficiency, and adaptability across various field conditions. The system integrates artificial intelligence (AI), machine vision, and mechatronic control to enable accurate seed placement and variable depth control for multiple crop types. The robot employs advanced sensors and computer vision algorithms to detect soil texture, moisture, and row alignment, ensuring uniform seed distribution and minimizing wastage. AI-based decision-making enables the robot to adjust seeding parameters dynamically according to real-time field data, crop requirements, and terrain irregularities. The design incorporates modular seed hoppers, a robotic arm for multi-row operation, and GPS-based navigation for autonomous field coverage. Field trials demonstrate enhanced sowing accuracy, reduced human labor, and increased productivity compared to conventional seeding methods. This research highlights the potential of intelligent robotic systems in promoting smart and sustainable agriculture through automation, precision, and resource optimization.

Keywords— Multi-crop seeding, AI control, agricultural robotics, precision farming, automation, smart agriculture, autonomous navigation.

FOG HARVESTING AND SUSTAINABLE WATER MANAGEMENT

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ABSTRACT: Water scarcity remains a critical challenge in arid and semi-arid regions, where conventional sources such as groundwater and rainfall are insufficient to meet agricultural and domestic demands. This study explores fog harvesting as a sustainable water management strategy, focusing on the design, optimization, and performance analysis of advanced fog collection systems suitable for diverse climatic and topographical conditions. The proposed system employs hydrophilic–hydrophobic hybrid mesh materials, optimized collector geometries, and AI-driven predictive models for fog occurrence and yield forecasting. Integration with solar-powered pumping and filtration units ensures continuous supply of potable water or irrigation-quality water with minimal energy input. The study also evaluates site-specific feasibility using meteorological data and geographic information system (GIS)-based mapping to identify optimal deployment zones.. The proposed fog harvesting framework contributes to climate-resilient water resource management, enabling decentralized, low-carbon, and cost-effective water supply solutions for agriculture and rural communities.

Keywords: Fog harvesting, Sustainable water management, Hybrid mesh materials, CFD simulation, Renewable energy integration.

ENGINEERING OF FLOATING MODULAR AGRO-PLATFORMS FOR SUSTAINABLE CROP CULTIVATION IN FLOOD-PRONE AGRICULTURAL REGIONS

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ABSTRACT- Recurrent flooding in low-lying agricultural regions severely disrupts crop production, damages soil fertility, and threatens food security. To address these challenges, this research focuses on the engineering of floating modular agro-platforms designed to enable sustainable crop cultivation in flood-prone environments. The proposed system integrates lightweight buoyant structures, hydroponic and soil-based cultivation modules, and renewable energy-powered automation for adaptive water and nutrient management. Each platform is constructed using recyclable composite pontoons and a modular interlocking frame, allowing scalability from smallholder to community-scale applications. Structural and hydrodynamic analyses are performed to optimize buoyancy, stability, and load distribution under varying flood levels and wind conditions. Computational simulations and prototype testing validate platform stability, anchorage reliability, and crop growth performance under controlled flood conditions.

Keywords: *Floating agriculture, Modular agro-platforms, Climate-resilient farming, Hydroponic systems, Flood adaptation, Renewable energy integration, Sustainable crop production.*

SENSORS IN PEST MANAGEMENT

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ABSTRACT: Pest management is a critical component of modern agriculture, influencing crop yield, food security, and economic sustainability. Traditional methods, while effective to a degree, often rely on reactive treatments, leading to excessive pesticide use, environmental degradation, and the development of pest resistance. The integration of sensor technologies into pest management systems represents a transformative shift toward precision agriculture. Sensors—ranging from optical and acoustic devices to thermal, olfactory, and hyperspectral imaging systems—enable real-time monitoring and early detection of pest populations and their behaviours. Such innovations allow for timely, data-driven decisions that optimize resource use and safeguard crops with minimal ecological footprint. Despite these advancements, challenges remain in cost-effectiveness, sensor calibration, data interoperability, and adoption by smallholder farmers. However, continued research and interdisciplinary collaboration promise to address these barriers. In conclusion, sensor technologies are revolutionizing pest management by enabling proactive, precise, and sustainable agricultural practices. Their integration is not merely an enhancement of existing systems but a foundational pillar for the future of smart farming.

Keywords—*AI control, smart agriculture, autonomous navigation*

AN AI-POWERED WELLNESS PLATFORM FOR WOMEN AND CHILDREN

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ABSTRACT: Women and children represent two of the most vital yet vulnerable segments of society, often facing challenges related to healthcare accessibility, timely diagnosis, and personalized wellness guidance. The project titled “An AI-Powered Wellness Platform for Women and Children” aims to develop an intelligent digital platform that leverages Artificial Intelligence (AI) and Data Analytics to monitor, assess, and improve overall physical and mental well-being. By combining technology with empathy, the project envisions creating a smart wellness ecosystem that empowers women and children to take proactive control of their health. This initiative supports Sustainable Development Goals (SDGs) related to good health and well-being, gender equality, and innovation in healthcare delivery.

Keywords- Artificial Intelligence, Women and Child Health, Wellness Platform, Machine Learning, Preventive Healthcare, Mental Wellness, Digital Health Monitoring, Personalized Recommendations, Smart Healthcare

DESIGN AND PERFORMANCE ANALYSIS OF LOW-COST POLYHOUSES FOR RURAL FARMERS

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Abstract: Protected cultivation offers significant potential to enhance agricultural productivity and crop quality, particularly in regions facing adverse climatic conditions. However, the high initial cost of conventional polyhouse structures limits their adoption among small and marginal farmers in rural areas. This study focuses on the design and performance analysis of low-cost polyhouses tailored for rural farming systems. The proposed design utilizes locally available materials such as bamboo, galvanized iron pipes, and UV-stabilized polyethylene sheets, reducing construction costs by up to 50% compared to standard models. The performance evaluation was conducted based on parameters such as microclimatic control (temperature, humidity, and light intensity), crop yield response, and economic feasibility. Results demonstrated that the low-cost polyhouse maintained a favorable microclimate with temperature moderation of 4–6°C and relative humidity enhancement of 15–20% compared to open fields. Crops such as tomato, capsicum, and cucumber showed yield improvements ranging from 25% to 40%, with a payback period of less than two years. The findings indicate that cost-effective polyhouse designs can significantly improve year-round cultivation potential, income generation, and climate resilience for rural farmers, thereby supporting sustainable agricultural development.

Keywords: Low-cost polyhouse, protected cultivation, rural farmers, microclimate, performance analysis, sustainable agriculture.

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AI-INT93	FROM DIAGNOSIS TO DISCOVERY: ADVANCED AI APPLICATIONS IN MODERN HEALTHCARE	RESHMA P, PRIYADHARSHAN P.S, SUDHARSANAN T, SRIRAM R, THAYANITHI R

AI-INT94	GENERATIVE AI AND LARGE LANGUAGE MODELS ADVANCES, CHALLENGES AND RESPONSIBLE DEPLOYMENT	GEETHA P V,GAGANA.S, HIBA KADHERHSA,NIHALA FATHIMA NOWSHAD
AI-INT95	GENERATIVE AI FOR DYNAMIC STORYTELLING IN GAMES	RESHMA P, JISHNU DEV A.S, JOYAL JOBY
AI-INT96	GREEN AI : BUILDING ENERGY-ENERGY EFFICIENT AND SUSTAINABLE MACHINE LEARNING MODELS	MARIMUTHU, MARIYA WILBET V, MUHAMMED HISHAM V,NABEEL S
AI-INT97	HANDLING EXPONENTIAL IOT DATA: STREAMING AND ANALYTICS	SREEVIDHYA S , RICHARD MATHEW M, RICKSON R,RATHISH K
AI-INT98	HUMAN-AI COLLABORATION: DESIGNING TRUSTWORTHY AND INTERACTIVE INTELLIGENT SYSTEMS	LEO FRANCIS P,JOSHVA AMALDOSS J,JOSEPH DYAGU M ,JOEL BACON
AI-INT99	HUMAN-COMPUTER INTERACTION, VISION, AND PERCEPTION IN ML SYSTEMS	GEETHA PV, PRINCE T, MUHAMMED SHANFIR S, AHAMMED K, ADIL MUJEEB
AI-INT100	HYBRID INTELLIGENCE: COMBINING HUMAN EXPERTISE WITH ARTIFICIAL INTELLIGENCE	SANITHA.P C,AMAL KRISHNA J, G.DHIL JAS RAM VJ,ABHIJITH KRISHNA P S
AI-INT101	IMPACT OF AI ON SOCIETY TRANSFORMING SOCIETY THROUGH AUTOMATIONS, ETHICS AND INNOVATIONS	NADHIYA S,MINI M, NAVYA KRISHNA K,MOHAMMED SHIBIL K
AI-INT102	IMPACT OF AI ON SOCIETY	RUFINA A,MUGILKUMAR P,PRAKASH V
AI-INT103	IMPACT OF AI ON SOCIETY	Dr. CHANDRASEKAR P, MOHAMMED SHINAJ, MUHAMMED SHAHIM, MOHAMMED FAHAD
AI-INT104	COMPUTING POWER CHALLENGES: ENERGY, EFFICIENCY,AND SCALABILITY	MARIMUTHU S, RUTHESH S U, SRIHARISH S , SACHIN S T
AI-INT105	COST-EFFECTIVE AI AND LOT BASED SMART SYSTEM FOR PRECISION WATER MANAGEMENT IN AGRICULTURE	MARIYA THERASA, P.GOKULRAJ, V.GOWTHAM,J.KARAN KUMAR
AI-INT106	DATA-CENTRIC AI: RETHINKING THE ROLE OF DATA IN MACHINE LEARNING SYSTEMS	MARIATHERASA , ABHAY C , ADIL KHAN A , AJAY KRISHNA A
AI-INT107	DEEP LEARNING-DRIVEN DISEASE DETECTION AND GROWTH MONITORING IN TOMATO PLANTS FOR SMART AGRICULTURE	SARITHA P S, M. DHILIP RAJKUMAR, P. KISHORE, S. DHARSAN

AI-INT108	EARLY CROP DISEASE DETECTION	RESHMA P, HARRISH S K, HARISH G, KAMALESH M
AI-INT109	EARLY DISEASE PREDICTION USING AI	MARIYA TERESA, SANJEEVAN.L, RISHI HARSHAN.K, RIBIN.K.V, SABARI PRASAD.T.K
AI-INT110	EDGE AI AND INTELLIGENT EDGE / COMPUTING CONTINUUM	GEETHA P V, MOHAMMED SUHAIB, MISVA GANI, GUHANATHAN
AI-INT111	EDGE AI INTELLIGENT COMPUTING AT THE DEVICE LEVEL	SRINJU M SANKARV YUVANMATHESHR YOGESHS
AI-INT112	EDGE INTELLIGENCE: OPTIMIZING MACHINE LEARNING MODELS FOR LOW – RESOURCE ENVIRONMENT	NADHIYA S, MAGESH V, MUNIYAPPAN K, NAGULAN POOVENDHIRAN P
AI-INT113	EDUTRUST AI: VERIFYING STUDENT SKILLS BEYOND MARKSHEETS	RUFINA A, BIYA B CLARA, CHARAN K, VINOETHINI S
AI-INT114	INTERPRETABLE AND SCALABLE MACHINE LEARNING FRAMEWORK FOR DERMATOLOGICAL INJURY CLASSIFICATION	K. MARIMUTHU, I. KALAI ARASAN, R. JANARTHANAN, S. KABILAN, K. SUDHAKAR
AI-INT115	ETHICAL IMPLICATIONS OF GENERATIVE AI: DEEPFAKES, ART, AND INTELLECTUAL PROPERTY	Dr. CHANDRA SEKAR P, AAKASH V, DIVYA DHARSHINI M, ELANGO K
AI-INT116	IOT-ENABLED PREDICTIVE MAINTENANCE FOR AUTOMOBILES: PREVENTING BREAKDOWNS WITH DATA	SANITHA P.C, ELVIN K SAJU, ANSAR, ANIRUDH K
AI-INT117	IMPACT OF AI ON SOCIETY	MARIMUTHU S, PRIYADHARSHAN S K, VIVEK PILLAI R, THIYAGESH S, THEJASHWIN R P
AI-INT118	MACHINE LEARNING FOR SUSTAINABLE DEVELOPMENT AND GREEN COMPUTING	Dr. CHANDRASEKHAR, RITHEESH KANNA M, VEERAPATHIRAN M, SANTHANA VISHAL C
AI-INT119	MACHINE LEARNING IN HEALTHCARE: EARLY DIAGNOSIS AND PREDICTIVE ANALYTICS	MARIYA THERASA, THARUN M, SEKUVERA THAMIZH SELVAN J, SAHAYA RICKSON I
AI-INT120	MINDCARE AI	SANITHA.PC, DHINAGARAN, DILIP R, CHANDRU T
AI-INT121	ML OPS IN ACTION: EFFICIENT DEPLOYMENT AND LIFECYCLE MANAGEMENT OF AI MODELS	MARIMUTHU S, PRASANNA M, NITHEESH D, GIRI PRASATH R

AI-INT122	MULTILINGUAL NATURAL LANGUAGE PROCESSING: BREAKING BARRIERS IN GLOBAL COMMUNICATION	RESHMA P , APARNA S , CHRISTABELL JESLIN SOFIA F , ADIN SHIFA S A
AI-INT123	NATURAL LANGUAGE PROCESSING AND THE FUTURE OF HUMAN COMPUTER INTERACTION	NADHIYA S , SAKTHIVEL M ,SURYA M , SANTHOSH R
AI-INT124	NEUROMORPHIC COMPUTING-AI	RUFINA , DHANUSH V, AGIL E S, AKASH S ,ARUNKUMAR A
AI-INT125	NATURAL LANGUAGE PROCESSING, SPEECH & AUDIO PROCESSING	NADHIYA .S, KISHANTH .S, NAGARAJ .S, YUVANSHAAKARRAJA .M
AI-INT126	NEXT-GENERATION AI-POWERED WEARABLE HEALTH MONITORING RING FOR REAL-TIME RISK DETECTION AND PROACTIVE HUMAN SAFEGUARDING	SRINJU M , MOHAMED RADHUWAN S , NITHISH KUMAR R , NIVAS M ,
AI-INT127	NEXT GENERATION COMPUTING WITH AI	SARITHA PS MOHAMED HARISH R MOHAMED ASHIK M MOHAMED RIYASKHAN M
AI-INT128	POWERED REAL – TIME WATER QUALITY MONITORING AND DISEASE OUTBREAK PREDICTION PLATFORM	Dr.CHANDRASEKAR.P,DHARSHAN.KD,JA YABHARATHI.A,JAYAVALAVAN.E
AI-INT129	PRECISION GUIDANCE OF AGRICULTURAL TRACTORS FOR AUTONOMOUS FARMING	SREEVIDHYA, K. EARAJANBU, T.GURU PRASATH, JEMIMA HALEETH
AI-INT130	PREDICTIVE ANALYTICS FOR EARLY DIAGNOSIS OF CHRONIC DISEASES USING MACHINE LEARNING	SANITHA.P.C , ARUNKUMAR.S , ADITHYAN MENON.T , AMRITHES.P.S
AI-INT131	NEUROMORPHIC HARDWARE : TOWARDS BRAIN-INSPIRED COMPUTING SYSTEMS	.SRINJU , M.DEEPA , P.ASWATHI , S.ASWANI
AI-INT132	REVOLUTIONIZING MOBILITY: SMART GLASSES FOR VISUALLY IMPAIRED INDIVIDUALS WITH OBJECT DETECTION AND NAVIGATION	SREEVIDHYA .S, ALFAS .Z, ALEESHA FATHIMA. PK, VARSHA .T
AI-INT133	SCALABLE ALGORITHMS FOR BIG DATA: BRIDGING THE GAP BETWEEN THEORY AND PRACTICE	SELVA BHUVANESHWARI S , SURYA C , MOHAMED RAJITH R , MOHAMED SHAFEEQ M
AI-INT134	SMART BUS TICKET SYSTEM	LEO FRANCIS P, R. GIRIVASAN, S. ELAVARASAAN, T. GOKUL ANAND
AI-INT135	THE RISE OF GENERATIVE AI: OPPORTUNITIES AND RISKS	SREEVIDHYA S VIGNESWARAN S, SIYAM M VIGNESH M

AI-INT136	THE ROLE OF AI IN SMART CITIES AND IOT ECOSYSTEMS	<i>SELVA BHUVANESHWARI S , SATHIYA MOORTHY P, SAM PRAISON M , TAMILARASAN R</i>
AI-INT137	TRAFFIC MODELING, ANOMALY DETECTION, AND PRIVACY IN NETWORK DATA	<i>Dr.P.CHANDRASEKAR, SUJAY SURESH, VENKADESH R, SHAHID S</i>
AI-INT138	TINY ML: DEPLOYING DEEP LEARNING MODELS ON MICROCONTROLLER AND IOT DEVICES	<i>MARIMUTHU, ASWIN K.N, DEVI K</i>
AI-INT139	TOWARDS EXPLAINABLE AI 2.0: INTERPRETING LARGE NEURAL NETWORKS BEYOND BLACK BOXES	<i>GEETHA P V, LOGASH S, PRASANNA J, NITHISH T</i>
AI-INT140	TRANSFER LEARNING , ENSEMBLE LEARNING, DISTRIBUTED & DECENTRALIZED ML	<i>LEO FRANCIS P, VINOTH KUMAR M, VIMAL M, YOGESH RAJA R</i>
AI-INT141	TOWARDS EXPLAINABLE AI 2.0: INTERPRETING LARGE NEURAL NETWORKS BEYOND BLACK BOXES	<i>RESHMA P, OVIYA SHREE J, POOJA S, HARIDHARSHINI S</i>
AI-INT142	TRUSTWORTHY & EXPLAINABLE AI FOR SOCIETY	<i>Dr. CHNADRA SEKAR P,PANDIYAN, PRADEEP, NOOR</i>
AI-INT143	TRUSTWORTHY GENERATIVE AI: DETECTING DEEPFAKE AND SYNTHETIC MEDIA	<i>LEO FRANCIS P, GOPIRAM S, KISHORE KUMAR M, HARI PRASATH B</i>
AI-INT144	UNLOCKING THE POWER OF RELATIONAL DATA	<i>SREEVIDHYA S KANIKA PRAKASHMADHAN KIRUSHYAK</i>
AI-INT145	DATA-CENTRIC AI: RETHINKING THE ROLE OF DATA IN MACHINE LEARNING SYSTEMS	<i>MARIATHERASA, ABHIJITH K H, ARYAN M T, AVINESH P A</i>
AI-INT146	AI SENTIMENT ANALYSIS	<i>SARITHA P S,MOHAMED ANAS, MUKESH PARVIN, MURALITHARAN</i>
AI-INT147	EVOLUTIONARY ALGORITHMS FOR HYPER PARAMETER OPTIMIZATION IN DEEP LEARNING	<i>MARIMUTHU, DHANUSH KRISHNA VD ,ANZIL HAKKIM,JAWFAR SADIQ N</i>
AI-INT148	GAMIFIED EDUCATION: TRANSFORMING LEARNING THROUGH GAME-BASED APPROACHES	<i>SANITHA, YAHYA ALI , SREE SHYAM S, AHAMEDNHADHI V K, VINAYAKAN JEEVAN</i>
AI-INT149	AI WHISPERNET: SILENT COMMUNICATION FOR THE DEAF AND PARALYZED	<i>SREEVIDHYA S ,G MEENAKSHI , R.MANIKANDAN ,MARIAVICTOR G</i>

AI-INT150	AN INTELLIGENT IOT-BASED VITAL SIGNS MONITORING AND ANOMALY DETECTION SYSTEM FOR REMOTE HEALTHCARE	S. SELVABHUVANESWARI, K.HARIDARSHINI, N.GOWSHIKA
AI-INT151	AUTOMATED MACHINE LEARNING: SIMPLIFYING MODEL SELECTION AND TUNING	SARITHA PS , DEVANG SV , AMAL V , BHAVIN RAJ MV
AI-INT152	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING: TRANSFORMING THE FUTURE OF SPACE MISSIONS	RESHMA P, JAYASOORYA Y, KRIDARTH K, PAWAN K SHERITH
AI-INT153	GREEN AI: BUILDING ENERGY-EFFICIENT AND SUSTAINABLE MACHINE LEARNING MODELS	MARIMUTHU S, SHEVAAG SHANJAI K S,SIVARLIN B, VISWA R, SANTHAN S,SIVA KUMAR S
AI-INT154	SENTIMENT ANALYSIS OF SOCIAL MEDIA POSTS ON MOVIES / OTT SERIES	SANITHA PC1,SMRITI SURESH , SREEMAYI DINESH MK, THARANIKA SRI T
AI-INT155	AUGMENTED ANALYTICS: AUTOMATING INSIGHT DISCOVERY THROUGH AI-DRIVEN DATA SCIENCE	Dr..CHANDRASEKAR P, PRATHYUSH B, PRASHANTH E R, JISHNU J
AI-INT156	EMOTION RECOGNITION AND RESPONSE GENERATION IN AI SYSTEMS: A MULTIDISCIPLINARY PERSPECTIVE	LEO FRANCIS P,,JEYA SURIYA M V, ,MANISHA V, HARINI T
AI-INT157	BLOCKCHAIN MEETS AI: SECURING DATA SHARING AND MODEL TRAINING	GEETHA P V, JACOB WELVIN ANTONY, PRASSANA S, SAAI SIDDHARTH T
AI-INT158	COGNITIVE NO-CODE AI PLATFORMS FOR LOW-TECH MSME ENVIRONMENTS	SRINJU M, VINAY SAI V , K..SAKTHIVEL ,YADU KRISHNA C M
AI-INT159	COMPUTER VISION IN SMART SURVEILLANCE: BALANCING SECURITY AND PRIVACY	SANITHA P.C, ANJANA V J , AMRITHA C C, ANAKHA M, ARSHA R
AI-INT160	5G AND AI INTEGRATION: ENABLING NEXT – GENERATION SMART CONNECTIVITY	SREEVIDHYA S, ANFAS S, ADITYA V, ABHINAV A
AI-INT161	ADVERSARIAL MACHINE LEARNING: CHALLENGES IN SECURITY AND ROBUSTNESS OF AI MODELS	RESHMA P, MUHAMMED SHAHIDH, NIKHIL P, NIDHIN HARI
AI-INT162	A NEW INTELLIGENT JAMMING ATTACKS DETECTION	SANITHA P C, MANOJKUMAR M, MATHAN K, DHAYA N
AI-INT163	AI - DRIVEN OPTIMIZATION OF CLOUD DATA CENTERS: INTELLIGENT WORKLOAD MANAGEMENT, PREDICTIVE MAINTENANCE, ENERGY EFFICIENCY	S SELVABHUVANESWARI, SAKTHISEKAR L, SAKTHISUNDARAM S, VISHATH S, VINOTH KUMAR K

AI-INT164	AI BASED SMART HOME SYSTEM	RESHMA P, DEEPAK, AJAY N R, ASHWIN S
AI-INT165	FEDERATION LEARNING OR PRIVACY PRESERVING AI : ALGORITHM CHALLENGES AND REAL WORLD APPLICATIONS	SANITHA P C, KAMALAKANNAN, HARIHARAN, MADHANRAJ
AI-INT166	AI-DRIVEN FRAUD DETECTION AND RISK PREDICTION IN FINTECH	NADHIYA S, APARNA T B, ARDHRA K S, ASMINA K
AI-INT167	AI FOR CLIMATE CHANGE: PREDICTIVE MODELING FOR ENVIRONMENTAL SUSTAINABILITY	SANITHA P C, AJEES M, ANDREW VESLEY G, DHARUN B, ELAKKIYA M
AI-INT168	FAKE PROFILE DETECTION ON SOCIAL MEDIA USING DEEP LEARNING	SANITHA P C ,BHARATH.K.,ANBAZHAGAN.M,. AJAY .R.,AKANTHIKAN KARANTH V
AI-INT169	AI IN EDUCATION : PERSONALIZED LEARNING SYSTEMS FOR THE FUTURE CLASSROOM	SREEVIDHYA S, POOJA J, KARISHMA B, HARINI V
AI-INT170	AI IN HEALTHCARE: TRANSFORMING DIAGNOSIS AND DRUG DISCOVERY	GEETHA P V, SRI KUMARAN V, VIGNESH P, SANKARAPANDIYAN P
AI-INT171	AI/ML FOR HEALTHCARE, MEDICAL IMAGE PROCESSING, REMOTE SENSING	SRINJU M, YOGESH RAJA R, YATHIRAI EZHILAN P, VIVEK S BABU
AI-INT172	AI-POWERED INDIGENOUS LANGUAGE PRESERVATION AND LEARNING	GEETHA P V, SELVABHARATHI S, ABINAYA SHREE S, KANIMOZHI M.D
AI-INT173	AI-POWERED CHATBOT	SRINJU M, KARTHICKRAJA A, AKASH V, GUNASEKARAPANDIAN S
AI-INT174	STRESS & BURNOUT DETECTOR USING AI	, LEO FRANCIS P, VIKASH S, PRITHIVIRAAJ VB, SUMAN V, RESHANTH KUMAR K
AI-INT175	ETHICS, PRIVACY AND RESPONSIBLE AI GOVERNANCE	SARITHA P S, SANJAY J, THANUSH M, SHANMUGA PRIYAN M
AI-INT176	QUANTUM COMPUTING AND ITS IMPACT ON AI& ML	RESHMA P, SUKUMAR M, SURENDIRAN S, VISHAL R
AI-INT177	FOG AND EDGE COMPUTING ARCHITECTURES FOR DISTRIBUTED AI SYSTEMS	RUFINA A, MUHAMMAD BASITH S, JOBEL JOSHY, FAHAD F

AI-INT178	SMART FARMING WITH EXPLAINABLE AI FOR EFFECTIVE AGRICULTURAL DECISION MAKING	SREEVIDHYA S, GOKUL PRASATH T, KARTHEESWARAN S, KALEESWARAN M
AI-INT179	BIG DATA ANALYTICS : DRIVING AI/ML BREAKTHROUGHS	RESHMA P, JITHIN J, KERTHICK RAJ B, HARISH A
AI-INT180	RESPONSIBLE AI: ENSURING BIAS FAIRNESS AND ETHICS IN MACHINE LEARNING	SARITHA PS, NANDIN PRADHAN, JANANI.S, NITHILA.B
AI-INT181	AMBULANCE TRAFFIC MANAGEMENT SYSTEM	MARIMUTHU S, PRAVIN KUMAR S, VISHWANATHAN S, RAGHUL S, SRIKANTH C
AI-INT182	IMPACT OF ARTIFICIAL INTELLIGENCE IN SOCIETY: OPPORTUNITIES, CHALLENGES, AND FUTURE DIRECTIONS	Dr.CHANDRASEKAR.P,NAVEENKARTHIC K.A,PUNITHKUMAR.K,MOHAN RAJ.S
AI-INT183	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING FOR PRECISION AGRICULTURE: A SYSTEMATIC REVIEW OF YIELD PREDICTION AND OPTIMIZATION TECHNIQUES	MARIYA THARASA, MIDUN.P ,JIJESH RAJ.KK,MANIKANDAN.P
AI-INT184	HYPERAUTOMATION - THE FUTURE	SREEVIDHYA S , MUKESH M , NISHANTH E, NIJITHIRAN P
AI-INT185	IMPACT OF AI ON SOCIETY	RUFINA A , MUGILKUMAR P, PRAKASH V
AI-INT186	AI AND DATA SCIENCE IN SMALL BUSINESS	Dr.CHANDRASEKAR.P,RAGUL K, RIGNATH P, NAVINKUMAR S
AI-INT187	AI AND THE FUTURE OF WORK	RAHUL D, MOHAN DHARSAN G, NOHAMED HADIL S
AI-INT188	NEXT GENERATION COMPUTING - AI	GEETHA P V , RAKESH K, RAMASAMY O, PARTHASARATHI Y
AI-INT189	TRUSTWORTHY & EXPLAINABLE AI FOR SOCIETY	Dr.CHANDRASEKAR.P , PANDIYAN, PRADEEP, NOOR
AI-EXT001	AI FOR CLIMATE CHANGE: DEEP LEARNING MODELS FOR EXTREME WEATHER PREDICTION	JAYABHARATHI, NIROJA, SREEDHIVYA PRABAA, SANKAREESWARI

AI-EXT002	IMPACT OF ARTIFICIAL INTELLIGENCE ON SOCIETY	JAYABHARATHI R, GANESHAMANIMOORTHY B, YOGESHKUMAR S, THAVAKANI M, KARTHIKEYAN S
AI-EXT003	A SURVEY TO DETECT FAKE FACES USING IMAGE VIA DYNAMIC TEXTURE	PRIMILA.B
AI-EXT004	ETHICAL AND INCLUSIVE RECRUITMENT SYSTEM USING GENERATIVE AI	R. PRIYANKA, S. MEENA, A. RAKSHITHA
AI-EXT005	PERSONALIZED MARKETING WITH MACHINE LEARNING IN SMALL RETAIL BUSINESSES	M. JAYA BHARATHI, DHESINGRAJA R, BHARATH KUMAR R, SARAN K, JEEVA KANNAN K
AI-EXT006	NEXT GENERATION COMPUTING –AI	JAYABHARATHI, JAYANTHI, LAVANYA, VISHALINI, KALPANA
AI-EXT007	LEVERAGING ARTIFICIAL INTELLIGENCE AND DATA SCIENCE FOR SMALL BUSINESS GROWTH: OPPORTUNITIES, CHALLENGES AND SOLUTIONS	DR. J. THILAGAVATHI., JASVANTH S., SUSMITHA R., KARTHIKEYAN S., RAGHULVARUNA S
AI-EXT008	AI-POWERED STUDENT LEARNING COMPANION: A CONSISTENCY, DECISION-MAKING, AND SELF-RELIANCE FRAMEWORK	DR.J. THILAGAVATHI, R. TAMILSELVAN, R. VISHWA, P. GOPI ALIAS KOTTURSAMY
AI-EXT009	AI-DRIVEN FRAMEWORK FOR AUTOMATED QUESTION PAPER GENERATION	D SUSEELA, ROHITH JAYIN KRISHNA R, MOHANA PRIYA S, SAKTHI M
AI-EXT010	AI-DRIVEN MULTI-STRATEGY ALGORITHMIC TRADING AND PORTFOLIO MANAGEMENT SYSTEM	SUJATHA .N ,SUJATHA .T ,JOSHUA .R , NAVEEN .L M ,SOUNDARYAA .S
AI-EXT011	NEXT-GEN PROGRAMMING EDUCATION USING AI GENERATED ANIMATED LESSONS	Mr. K BALAJ , NARENDRAN C M , MUGESH V , RAJESH R
AI-EXT012	SMART CAMPUS CONNECT: REAL-TIME ATTENDANCE STAFF LOCATION MANAGEMENT SYSTEM	Mr. K BALAJI , SANJAI K , JAI AKASH S , SURIYA G
AI-EXT013	ADAPTIC DIDACTIC INFRASTRUCTURE FOR NOVICE LEARNERS WITH PEDAGOGY USING AI	S SENTHIL KUMAR, LOGESH S BRINDA P V, SANKAR P N

AI-EXT014	ANALYSIS AND CLASSIFICATION USING MACHINE LEARNING ALGORITHMS FOR EARLYSTAGE PREDICTION OF ALZHEIMER'S DISEASE	SENTHIL KUMAR S, PRIYANKA K, JAYA PRAGADHEESH P , PREETHY S, MONISHA SD
AI-EXT015	AUTOMATED EXTRACTION OF STRUCTURED DATA FROM IDENTITY DOCUMENTS FOR FINANCIAL SERVICES	KIRUBHANANDAN CG,KRUSHNA R ,ARUN PANDIAN P,DHARSHINI PRAJA S , AJAI S,
AI-EXT016	AI-BASED COMPLIANCE ASSISTANCE USING LLM'S FOR STARTUPS	G.S. PUGALENDHI M.E,(PHD),ATIMANYU K.S2,ASHIKA S.M, K.R SHRIRAAM
AI-EXT017	AN AI POWERED MOBILE APPLICATION DETECTION AND MONITORING -SMART WOUND USING ML	S SENTHIL KUMAR,S JOSHICA,S KEERTHIKA, S HEMAMALINI,D HARINI,S.K KANISHK
AI-EXT018	IMPACT OF ARTIFICIAL INTELLIGENCE ON SOCIETY	JAYABHARATHI R, VINOOTH KUMAR.K, GANESH VS,SAMBA SIVARAO , ASGARALI B
AI-EXT019	MULTIMODAL GENERATIVE AI FOR PERSONALIZED LEARNING IN EDUCATION	M PAVITHRA, M.BHAVANI, M.VENKATA LAKSHMI,I.VELKUMAR
AI-EXT020	OPTIMIZED RESOURCE ALLOCATION FOR HOMELESS SHELTER MANAGEMENT	A.WASIM RAJA, RANGANITHILESH R,RAKISHA R, SARAN V
AI-EXT021	SAFESPACE: AN AI-ENABLED WOMEN'S SAFETY MOBILE APPLICATION WITH SOS ALERTS, OFFLINE GPS TRACKING, AND CONTEXT-AWARE AUDIO RECORDING	NIDHARSANA K S,AHABRES AHMED T ,ROSHINI A
AI-EXT022	ENHANCING PERSON RE-IDENTIFICATION FOR ROBUST SURVEILLANCE SYSTEM	RAASHMA MAHABOOB M.E ,GOHUL V K,DHARANIDHAR S,LOGICHANDRAN J

ADVANCED AI APPLICATION IN HEALTHCARE

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Abstract: Advancements in Artificial Intelligence (AI) are revolutionizing the healthcare sector by enabling more accurate diagnosis, personalized treatment, and efficient patient management. AI-powered systems can analyze large volumes of medical data, detect patterns, and support clinical decision-making with speed and precision beyond human capacity. Applications such as medical imaging analysis, drug discovery, predictive analytics, virtual health assistants, and robotic surgery are transforming patient care and healthcare delivery. Moreover, AI enhances preventive healthcare through early disease detection and remote patient monitoring, reducing costs and improving accessibility. While challenges related to data privacy, ethical considerations, and integration with existing healthcare systems remain, the potential of AI to improve outcomes, optimize resources, and democratize healthcare is immense. This paper highlights the key applications, benefits, and challenges of advanced AI in healthcare, emphasizing its role in shaping the future of modern medicine.

Keywords: Artificial Intelligence (AI), Healthcare, Medical Imaging, Predictive Analytics, Personalized Medicine, Robotic Surgery, Drug Discovery, Clinical Decision Support, Remote Patient Monitoring, Healthcare Innovation.

AI - ENHANCED AUTOMATIC DESIGN OF EFFICIENT UNDERWATER GLIDERS

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Abstract : Autonomous underwater glider design has traditionally been limited by narrow hull geometries and manual trial-and-error, leading to hydrodynamic efficiencies far below biologically evolved swimmers. Automating this process is challenging due to high-dimensional shape parameterization and computationally intensive fluid-structure simulations. This paper presents an AI-assisted framework that jointly optimizes hull morphology and control strategies to maximize hydrodynamic performance. Hulls are parameterized using a deformation-cage representation with reduced degrees of freedom, enabling diverse geometries with manageable complexity. A differentiable Graph Neural Network (GNN) surrogate model predicts lift and drag coefficients across angles of attack with <5% error relative to full-scale CFD simulations, significantly accelerating design evaluation. Results show that optimized gliders achieve lift-to-drag ratios up to eight times higher than conventional torpedo-shaped designs, demonstrating the effectiveness of AI-driven design in discovering unconventional, high-performance underwater vehicles.

Keywords : Autonomous underwater glider, Hull morphology optimization, Hydrodynamic performance, Graph Neural Network surrogate, Surrogate-assisted modelling, Multi-objective evolutionary optimization,

AI AND ETHICS

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Abstract: As Artificial Intelligence (AI) increasingly permeates various aspects of society, ethical concerns surrounding its development and deployment have come to the forefront. This paper explores the complex intersection of AI and ethics, examining issues such as bias, transparency, accountability, and privacy. It discusses the potential consequences of unchecked AI development, including exacerbation of existing social inequalities and erosion of trust in institutions. The paper also highlights the need for a multidisciplinary approach to AI ethics, incorporating insights from philosophy, law, and computer science to ensure that AI systems are designed and deployed in ways that prioritize human well-being, dignity, and values.

Keywords: AI Ethics, Bias, Transparency, Accountability, Privacy, Human Values.

AI FOR SUSTAINABLE DEVELOPMENT AND SOCIETAL GROWTH

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Abstract: Artificial Intelligence (AI) is rapidly transforming the global landscape, offering unprecedented opportunities to address complex challenges associated with sustainable development and societal well-being. This paper explores the multifaceted role of AI in advancing the United Nations Sustainable Development Goals (SDGs), with a focus on environmental stewardship, equitable resource distribution, and inclusive social progress. Through case studies and cross-sectoral analysis, we examine how AI-driven innovations—such as predictive analytics for climate resilience, intelligent energy management systems, and AI-enabled healthcare diagnostics—are reshaping traditional paradigms of development. We also critically assess the ethical, economic, and governance implications of deploying AI at scale, particularly in low-resource settings. The findings underscore the need for transparent, human-centric AI frameworks that prioritize equity, accountability, and long-term sustainability. By bridging technological advancement with social responsibility, this research advocates for a future where AI serves not only as a tool for efficiency but as a catalyst for transformative societal impact.

Keywords: Artificial Intelligence (AI), Sustainable Development Goals (SDGs), Environmental Stewardship,.

AI IN AGRICULTURE: PRECISION FARMING AND FOOD SECURITY

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Abstract: Agriculture is the cornerstone of human survival but faces mounting challenges from climate change, limited resources, and population growth. To achieve sustainable food production, Artificial Intelligence (AI) is emerging as a transformative force in modern farming. Through precision agriculture, AI technologies such as sensors, drones, computer vision, and machine learning enable real-time monitoring and intelligent decision-making. These tools optimize irrigation, fertilization, pest control, and yield prediction, reducing resource wastage while boosting productivity. Additionally, AI-powered predictive analytics enhance supply chain efficiency and support early warning systems for crop failures, strengthening. The integration of AI with Internet of Things (IoT) devices and cloud computing further provides scalable solutions for smallholder farmers, democratizing access to advanced tools. Looking ahead, the convergence of AI with robotics, blockchain, and biotechnology promises breakthroughs in food traceability, crop resilience, and climate-smart agriculture. However, challenges remain, including data privacy, infrastructure limitations, and the need for farmer training and digital literacy. This paper explores the role of AI in precision agriculture, its applications, benefits, and barriers, highlighting its potential to revolutionize farming and ensure long-term food security.

Keywords : Artificial Intelligence, Precision Farming, Smart Agriculture, Food Security, Predictive Analytics.

AI IN EDUCATION – PERSONALIZED LEARNING AND DIGITAL CLASSROOM

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Abstract: Artificial Intelligence (AI) in education is revolutionizing the traditional learning landscape by enabling personalized learning experiences and transforming digital classrooms. By leveraging AI technologies, educational institutions can customize learning paths based on individual students' abilities, needs, and learning pace, ensuring more effective knowledge acquisition. Digital classrooms integrated with AI tools enhance interactivity, deliver real-time feedback, and assist educators in monitoring student progress with greater accuracy. By introducing AI-driven innovations, this project bridges modern technology with educational practices, offering a scalable, reliable, and learner-centric approach.

Keywords: Artificial Intelligence, Personalized Learning, Digital Classrooms, Adaptive Education, Student

AI/ML FOR HEALTHCARE, MEDICAL IMAGE PROCESSING, REMOTE SENSING

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Abstract: Artificial Intelligence (AI) and Machine Learning (ML) are rapidly revolutionizing healthcare by intensifying the accuracy of medical diagnostics, automating data analysis, and enabling tailored treatment planning across specialties such as radiology, pathology, and oncology. In medical image processing, deep learning algorithms facilitate early disease detection by identifying subtle features in radiographs, MRIs, and histopathology slides, surpassing traditional methods in efficiency and precision. Furthermore, remote sensing—driven by AI—supports real-time patient monitoring and predictive analytics, expanding healthcare reach beyond clinic walls to ambulatory care and telemedicine. Despite the transformative promise, key challenges remain, including data privacy, algorithmic bias, and integration with existing clinical workflows, necessitating robust validation, ethical frameworks, and interdisciplinary collaboration for responsible AI deployment. The comprehensive integration of AI/ML in healthcare stands poised to enhance patient outcomes, streamline clinical operations, and advance the future of precision medicine and remote care delivery.

Keywords: Artificial Intelligence, Machine Learning, Radiographs.

AI-BASED ROCKFALL PREDICTION AND ALERT SYSTEM FOR OPEN-PIT MINES

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Abstract: Rockfalls are one of the most critical safety hazards in open-pit mines, often leading to equipment damage, production delays, and threats to human life. Traditional monitoring methods, such as visual inspections and geotechnical sensors, are often limited by delayed detection and human error. An AI-based rockfall prediction and alert system leverages machine learning algorithms, real-time sensor data, and computer vision to identify early signs of slope instability. By analyzing parameters such as vibration, stress variations, weather conditions, and geological features, the system can forecast potential rockfall events with higher accuracy. Integrated alert mechanisms ensure timely warnings to mine operators, enabling proactive evacuation and risk mitigation. This approach enhances operational safety, reduces downtime, and represents a significant step toward fully automated and intelligent mine safety management.

Keyword: Artificial Intelligence (AI), Machine Learning, Rockfall Prediction, Open-Pit Mines, Slope Stability, Computer Vision, Real-Time Monitoring.

AI-DRIVEN CROP DISEASE PREDICTION AND MANAGEMENT SYSTEM

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Abstract: Agricultural productivity is significantly affected by crop diseases, leading to reduced yield, economic losses, and threats to global food security. Early detection and effective management of these diseases are essential to support sustainable farming practices. This project presents an AI-Driven Crop Disease Prediction and Management System that leverages machine learning and computer vision techniques to identify plant diseases at an early stage with high accuracy. The system uses image datasets of diseased and healthy crops to train deep learning models capable of classifying and predicting the type and severity of infections. The proposed solution not only diagnoses crop diseases but also provides farmers with tailored management recommendations, including preventive measures and suitable treatment options. By automating disease monitoring and decision-making, this innovation reduces dependency on manual inspection, minimizes crop loss, and optimizes the use of resources.

Keywords: Artificial Intelligence, Crop Disease Prediction, Machine Learning, Precision Agriculture, Sustainable Farming.

AI-DRIVEN CYBERSECURITY: DEFENCE IN THE AGE OF SCIENCE

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Abstract: Digital technologies are growing quickly, which has helped businesses, governments, and people a lot. But this has also led to a new generation of cyber threats that are smart, adaptable, and harder to find. Traditional cybersecurity measures, which are mostly reactive, don't always work against these new smart attacks. Artificial Intelligence (AI) is becoming a game-changer in cybersecurity by providing proactive, smart, and automated ways to protect systems. This paper looks at how AI-driven cybersecurity changes modern defence strategies by making it possible to do predictive analysis, cutting down on the need for manual monitoring, and making systems more resilient overall. It also talks about important problems that need to be solved in order to make sure that the implementation works properly, such as adversarial AI attacks, ethical issues, and privacy concerns. The study highlights the dual function of AI through case studies and recent developments, portraying it as both a defensive asset and a potential instrument for cybercriminals. In the end

Keywords: Artificial Intelligence, Cybersecurity, Machine Learning, Deep learning, Automated Defence.

AI-DRIVEN IMAGE RECOGNITION AND IOT INTEGRATION FOR EFFICIENT AIRCRAFT MAINTENANCE TOOL MANAGEMENT

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Abstract: Efficient management of aircraft maintenance tools is critical for ensuring flight safety and operational reliability. This paper investigates the application of Artificial Intelligence (AI) and Computer Vision techniques for automated tool recognition, real-time tracking, and inventory optimization in aviation maintenance. Leveraging Convolutional Neural Networks (CNNs) and Transformer-based vision models, the proposed system achieves high-precision tool identification with reported accuracies exceeding 95% under diverse operational conditions. The study demonstrates significant improvements in inventory accuracy, turnaround time, and error reduction through case studies in maintenance hangars. Furthermore, the paper explores the potential of IoT-enabled smart tool racks, RFID augmentation, and predictive analytics using LSTM models for proactive maintenance scheduling. The proposed framework highlights the transformative role of AI in modernizing aircraft maintenance workflows, enhancing safety, and supporting the digital transformation of aviation operations.

Keywords: Aircraft Maintenance, Artificial Intelligence (AI), Computer Vision, Tool Tracking, Predictive Analytics, Convolutional Neural Networks (CNNs), IoT Integration, Inventory Management, Object Detection, Digital Transformation.

AI-POWERED SMART BUSINESS ASSISTANT FOR SMALL ENTERPRISES

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Abstract: Small businesses often face challenges in decision-making due to limited resources, fragmented data, and rapidly changing market conditions. This project proposes an AI-Powered Smart Business Assistant that integrates machine learning, natural language processing, and predictive analytics to provide actionable insights and automate business operations. The system offers sales forecasting, customer churn prediction, sentiment analysis from reviews and social media, dynamic pricing suggestions, inventory optimization, and personalized marketing recommendations. Interactive dashboards allow owners to monitor key performance indicators (KPIs) in real-time, enabling data-driven decision-making. By leveraging Python-based ML frameworks, NLP models, and visualization tools, this platform demonstrates how AI can empower small enterprises to increase efficiency, enhance customer satisfaction, and drive growth.

Keywords: AI for Small Business, Predictive Analytics, Customer Sentiment Analysis, Sales Forecasting, Dynamic Pricing, Inventory Optimization, Decisions.

AI-POWERED CYBERSECURITY

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Abstract: The rapid growth of digital technologies has led to a significant rise in cyber threats, making traditional security methods insufficient to handle advanced and evolving attacks. Artificial Intelligence (AI) provides a transformative approach to cybersecurity by enabling intelligent threat detection, predictive analysis, and automated defense mechanisms. Through machine learning algorithms and data-driven models, AI systems can process vast amounts of information, identify anomalies, and respond to threats in real time. AI also enhances intrusion detection systems, malware analysis, and phishing prevention, while adaptive learning capabilities allow for continuous improvement in defense strategies. Despite these advancements, challenges such as adversarial AI, ethical concerns, and implementation costs remain. This project highlights the role of AI-powered cybersecurity in creating resilient, adaptive, and proactive security infrastructures that ensure data protection and safeguard digital ecosystems in the modern era.

Keywords : Artificial Intelligence, Cybersecurity, Machine Learning, Threat Detection, Automated Defense.

AI-POWERED HEALTHCARE MANAGEMENT AND DIAGNOSIS

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Abstract: The integration of artificial intelligence into healthcare is opening up new frontiers in patient care, clinical efficiency, and medical research. This paper presents a comprehensive digital platform that tackles the everyday challenges of healthcare scheduling while also laying the groundwork for advanced AI-driven diagnostics and drug discovery. Our system brings together two powerful components: a user-friendly Healthcare Appointment Web App and a cutting-edge Tesseract OCR engine. This combination creates a seamless experience for patients, doctors, and administrators alike. The platform features secure, role-based access, an intuitive appointment booking system with calendar integration, and personalized dashboards for managing patient data and clinical schedules. With built-in teleconsultation, automated reminders, and electronic health record (EHR) management, we empower healthcare professionals to provide more efficient and patient-focused care. What makes our approach unique is the integration of an advanced OCR engine, which uses a neural network (LSTM) to recognize over 100 languages and process a wide range of image formats.

Keywords: Artificial Intelligence, Healthcare Management, Optical Character Recognition (OCR), Electronic Health Records (EHR), Teleconsultation, Machine Learning, Digital Health, Clinical Workflow, Drug Discovery, Diagnostic AI.

AI-POWERED VIRTUAL HUMANS FOR METAVERSE APPLICATIONS

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Abstract: AI-powered virtual humans are emerging as central actors in the metaverse, enabling immersive and personalized interactions across education, healthcare, entertainment, and enterprise collaboration. Unlike traditional avatars, these digital entities integrate multimodal perception, natural language understanding, affective computing, and adaptive reasoning to deliver lifelike, emotionally intelligent engagement. However, their deployment also raises pressing concerns around privacy, algorithmic bias, deepfake misuse, and identity governance. This study proposes a comprehensive framework for trustworthy and sustainable virtual humans that combines advanced conversational AI, emotion modeling, and blockchain-based digital identity verification with ethical governance principles. The framework emphasizes transparency, fairness, user autonomy, and energy-efficient AI architectures to ensure scalability across diverse metaverse platforms. Validation through prototype implementations in educational and healthcare environments demonstrates significant improvements in realism, user trust, and interaction continuity compared to conventional avatars. By addressing both technical and ethical challenges, this work advances the design of explainable, interoperable, and future-proof virtual humans, laying the foundation for inclusive and sustainable metaverse ecosystems.

Keywords: Virtual humans, Metaverse, Artificial intelligence, Affective computing, Blockchain identity, Ethical AI, Immersive interaction, Sustain.

AI FOR SMART CITIES: OPTIMIZING ENERGY, TRAFFIC, AND URBAN PLANNING

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Abstract: Artificial Intelligence (AI) is emerging as a transformative force in the development of smart cities, enabling efficient resource management and sustainable urban growth. In the energy sector, AI enhances demand forecasting, integrates renewable sources, and supports smart grids and adaptive building systems to reduce waste. In transportation, AI-driven predictive analytics, dynamic traffic control, and intelligent public transit systems improve mobility, safety, and congestion management. For urban planning, AI leverages big data and digital twin models to optimize land use, forecast population growth, and guide sustainable infrastructure development. By unifying these domains, AI facilitates data-driven decision-making that enhances livability, reduces environmental impact, and fosters resilient, future-ready urban ecosystems.

Keyword: Artificial intelligence, Smart Cities, Sustainable Urban Development, Resource Management, Energy Sector, Renewable Energy Integration, Adaptive Building Systems, Transportation Systems.

AI IN PERSONALISED LEARNING AND ASSESSMENT

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Abstract: The integration of Artificial Intelligence (AI) in education is reshaping traditional approaches to learning and assessment by enabling more personalized, adaptive, and data-driven experiences for learners. Personalized learning powered by AI leverages intelligent algorithms to analyze student performance, learning styles, and behavioral patterns, thereby tailoring content delivery and pace according to individual needs. This ensures that learners receive targeted support, timely feedback, and appropriate challenges, enhancing both engagement and outcomes. Similarly, AI-driven assessment tools move beyond conventional testing by incorporating formative, real-time, and competency-based evaluation methods. These systems can provide immediate, actionable insights for educators while reducing bias and administrative workload. However, the adoption of AI in education also raises important concerns related to ethics, data privacy, and equitable access. This paper explores the transformative role of AI in personalized learning and assessment, highlighting opportunities, challenges, and implications for educators, policymakers, and learners in shaping the future of education.

Keywords: Artificial Intelligence (AI), Personalized Learning, Adaptive Learning, Intelligent Tutoring Systems, AI-driven Assessment, Formative Assessment, Summative Assessment, Competency-based

ARTIFICIAL INTELLIGENCE: HEALTHCARE SYSTEMS AND MEDICAL IMAGING

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Abstract: The integration of Artificial Intelligence (AI) into healthcare systems and medical imaging is revolutionizing the way diseases are detected, diagnosed, and treated. AI-powered algorithms enhance the accuracy and speed of medical imaging interpretation, enabling early detection of critical conditions such as cancer, cardiovascular disorders, and neurological diseases. By leveraging machine learning and deep learning techniques, healthcare systems can process large volumes of medical data, reduce diagnostic errors, and support clinicians in making informed decisions. Furthermore, AI facilitates personalized treatment planning, remote patient monitoring, and predictive analytics, leading to improved patient outcomes and optimized resource utilization. Despite challenges related to data privacy, model transparency, and ethical concerns, AI in healthcare and medical imaging holds immense potential to transform modern medicine into a more efficient, accessible, and patient-centric system.

Keywords: AI for Healthcare System, Medical Imaging, Disease Diagnosis, Machine Learning, Deep Learning, Predictive Analytics, Patient Care.

ARTIFICIAL INTELLIGENCE IN ENTERTAINMENT

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Abstract: Artificial Intelligence (AI) is rapidly transforming the entertainment industry by reshaping how content is created, delivered, and experienced. From personalized recommendations on streaming platforms to AI-driven special effects in movies, the integration of intelligent systems is revolutionizing audience engagement. In music, AI is assisting with composition, remixing, and sound design, while in gaming, it powers adaptive storytelling, lifelike characters, and immersive virtual environments. The rise of generative AI has also enabled new forms of creativity such as automated scriptwriting, animation, and visual content production, reducing time and costs while expanding artistic possibilities. Moreover, AI-driven analytics are providing deep insights into audience behavior, enabling creators and producers to tailor content more effectively. However, alongside these opportunities lie challenges related to ethics, originality, and the impact on human creativity. This abstract highlights the role of AI as both a tool and a disruptor in the entertainment sector, emphasizing its potential to redefine the future of storytelling, performance, and audience interaction.

Keywords: Artificial Intelligence, Water Safety, IoT, Machine Learning, Real-time Monitoring, Sustainable Development.

ARTIFICIAL INTELLIGENCE IN HEALTHCARE

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Abstract: Artificial Intelligence (AI) is revolutionizing the healthcare sector by enabling faster, more accurate, and cost-effective solutions to complex medical challenges. AI-powered decision support systems are assisting doctors in reducing diagnostic errors, while robotic-assisted surgeries and virtual health assistants enhance precision and patient engagement. Furthermore, AI contributes to efficient hospital management through smart electronic health records and real-time monitoring of patients. However, challenges such as data privacy, algorithmic bias, and ethical concerns must be addressed to ensure safe and transparent implementation. This study emphasizes the transformative role of AI in healthcare, highlighting both its current applications and future potential in creating a sustainable, inclusive, and patient-centric healthcare ecosystem.

Keywords: Artificial Intelligence, Healthcare, Machine Learning, Medical Imaging, Disease Prediction, Personalized Treatment, Drug Discovery, Ethical AI, Digital Health.

ARTIFICIAL INTELLIGENCE DRONE-BASED FOREST FIRE DETECTION

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Abstract: Forest fires pose a severe threat to biodiversity, human life, and the environment, often resulting in large-scale ecological and economic damage. Traditional fire detection methods, such as satellite monitoring and ground-based surveillance, are often delayed and limited by weather conditions. This project proposes a Drone-based Forest Fire Detection System that integrates Artificial Intelligence (AI), Computer Vision, and IoT sensors to enable real-time monitoring and early fire detection. Equipped with thermal imaging cameras, gas sensors, and machine learning algorithms, drones can autonomously patrol forest areas, detect abnormal temperature fluctuations, smoke, or fire signatures, and immediately alert authorities. The system enhances accuracy, reduces response time, and minimizes false alarms compared to conventional methods. By providing real-time data and geo-coordinates of the affected area, this drone-based approach strengthens preventive measures and supports rapid decision-making for disaster management teams. The solution is cost-effective, scalable, and highly beneficial for safeguarding ecosystems and human communities against wildfire hazards.

Keywords : Drone Technology, Forest Fire Detection, Artificial Intelligence, Computer Vision, IoT, Thermal Imaging, Disaster Management, Early Warning System.

AMBIENT IOT TOWARDS 6G: STANDARDIZATION POTENTIALS &CHALLENGES

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Abstract: The evolution of wireless communication has advanced from 1G voice networks to 5G ultra-broadband systems, paving the way for the emergence of sixth-generation (6G) networks. One of the most transformative paradigms envisioned for 6G is the Ambient Internet of Things (Ambient IoT), which integrates trillions of devices seamlessly into human environments to enable intelligent, context-aware, and adaptive services. The integration of Ambient IoT into 6G networks opens up enormous possibilities, including smart healthcare with continuous remote monitoring, smart cities with predictive infrastructure management, industry 5.0 powered by autonomous machines and digital twins, and sustainability-oriented systems that minimize energy consumption and reduce environmental impact. Furthermore, the integration of trillions of devices poses scalability concerns that require innovative network architectures and intelligent resource management.

Keywords: Electric Vehicles, Renewable energy, IoT.

ARTIFICIAL INTELLIGENCE GEN AI WITH LLM

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Abstract: Artificial Intelligence (AI) has evolved from rule-based systems to highly advanced models capable of understanding, reasoning, and generating human-like responses. One of the most significant breakthroughs in this field is the emergence of Generative Artificial Intelligence (GenAI) powered by Large Language Models (LLMs). These models, trained on massive datasets, can perform a wide range of tasks including natural language processing, code generation, creative writing, summarization, and decision support. GenAI with LLMs is transforming industries such as healthcare, education, finance, and customer service by enabling automation, personalization, and innovation at scale. Despite their potential, challenges such as ethical concerns, data privacy, computational costs, and bias in outputs need to be addressed for responsible deployment. This paper explores the applications, opportunities, and limitations of GenAI with LLMs, emphasizing their role in shaping the future of intelligent systems.

Keywords : Artificial Intelligence, Generative AI, Large Language Models, Natural Language Processing, Deep Learning, Automation, Innovation, Responsible AI.

ARTIFICIAL INTELLIGENCE IN AGRICULTURE: SMART FARMING AND CROP PREDICTION

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Abstract: The integration of Artificial Intelligence (AI) in agriculture is revolutionizing traditional farming practices by enabling smart, data-driven decision-making. Smart farming leverages advanced technologies such as machine learning, computer vision, and Internet of Things (IoT) devices to monitor soil health, weather conditions, crop growth, and pest activity in real time. AI-powered systems enhance efficiency by predicting crop yields, identifying diseases early, and optimizing resource use, including water, fertilizers, and pesticides. Crop prediction models, built on big data analytics, provide farmers with accurate insights for planning and risk management, reducing losses and increasing productivity. This transformation not only improves food security but also supports sustainable agriculture by minimizing environmental impact. As AI continues to evolve, its applications in precision farming hold significant potential for addressing global challenges in food production and climate change.

Keywords: Artificial Intelligence, Smart Farming, Precision Agriculture, Crop Prediction, Machine Learning, IoT in Agriculture, Sustainable Farming.

ARTIFICIAL INTELLIGENCE IN SCIENCE

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Abstract: Artificial Intelligence (AI) is transforming the face of modern science at a fast pace, speeding up discoveries, increasing accuracy, and making new approaches that were previously out of reach feasible. In fields such as physics, chemistry, biology, and environmental science, AI systems are being used to analyze vast datasets, uncover hidden patterns, and model complex processes. AI also plays a crucial role in laboratory automation, with robotics and smart sensors reducing human error and improving efficiency. Increasingly, research publications and scientific trends are mined using natural language processing to identify emerging domains and accelerate knowledge sharing. Furthermore, AI-driven high-performance computing is supporting large-scale simulations in areas such as quantum mechanics, genomics, and particle physics. Despite its revolutionary impact, challenges remain in ensuring data reliability, interpretability of models, and maintaining ethical integrity in scientific discovery. This paper provides an overview of the most impactful applications of AI across multiple scientific disciplines, emphasizing its potential not only to accelerate discoveries but also to redefine the future of scientific inquiry.

Keywords: Artificial Intelligence, Machine Learning, Deep Learning, Scientific Discovery, Data Analysis, Quantum Mechanics, Climate Science, Astronomy.

ARTIFICIAL INTELLIGENCE IN WATER SAFETY TRACKER

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Abstract: Access to clean and safe water is a fundamental requirement for human health and sustainable development. However, growing industrialization, climate change, and improper waste management have significantly increased the risk of water contamination. Traditional water testing methods are often manual, time-consuming, and lack real-time monitoring, which limits their effectiveness in ensuring public safety. To address these challenges, this project proposes the development of an Artificial Intelligence (AI)-based Water Safety Tracker, a smart and scalable system designed to monitor, analyze, and predict water quality in real time. By employing supervised and unsupervised AI models, the tracker enhances accuracy in predicting unsafe water conditions while minimizing false positives. A mobile and web-based application provides end-users with easy access to real-time dashboards, visual analytics, and safety notifications, ensuring greater community awareness and rapid response to contamination risks. This innovation not only reduces the dependence on manual testing but also ensures continuous monitoring with minimal human intervention.

Keywords: Artificial Intelligence, Water Safety, IoT, Machine Learning, Real-time Monitoring, Sustainable Development

A NEW DEEP LEARNING STRATEGY TO PREDICT TIME SERIES OF MARINE DIESEL ENGINE

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Abstract: Reliable time series prediction of marine diesel engines is essential for improving efficiency, reducing maintenance costs, and preventing failures in maritime operations. Traditional model often struggles to capture the complex non-linear behaviour of these engines under varying conditions. This paper presents a deep learning — based strategy using a hybrid architecture that combines Convolutional Neural Network (CNNs) for feature extraction and long short term memory (LSTM) network for temporal modelling. An attention mechanism is integrated to enhance the model's ability to focus on critical time dependent patterns. A pre- processing pipe line- including anomaly detection, normalisation and feature Reliable time series prediction of marine diesel engines is essential for improving efficiency, reducing maintenance costs, and preventing failures in maritime operations. Traditional models often struggle to capture the complex, nonlinear behavior of these engines under varying conditions.

Keywords: Deep Learning, Convolutional Neural Network (CNN), Long short term memory (LSTM), Pre-processing.

AI TOOLS FOR SENTIMENT ANALYSIS

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Abstract: Sentiment analysis, also known as opinion mining, is an emerging field in Natural Language Processing (NLP) that focuses on identifying and categorizing opinions expressed in text data. With the increasing use of social media, online reviews, and digital platforms, analysing sentiments has become a crucial tool for businesses, policymakers, and researchers. This project emphasizes the application of Artificial Intelligence (AI) tools to perform sentiment analysis with accuracy, scalability, and efficiency. The system employs advanced machine learning and deep learning models, such as Support Vector Machines (SVM), Recurrent Neural Networks (RNN), and Transformer-based architectures like BERT, to classify text into categories such as positive, negative, or neutral. By automating the process, AI-powered sentiment analysis reduces human bias, handles large scale unstructured data, and provides actionable insights. This project bridges human emotional understanding and computational intelligence, offering a standardized, reliable, and scalable approach to sentiment detection.

Keywords: Sentiment Analysis, Artificial Intelligence, NLP, Machine Learning, Deep Learning,

AI - DRIVEN OPTIMIZATION OF CLOUD DATA CENTERS: INTELLIGENT WORKLOAD MANAGEMENT, PREDICTIVE MAINTENANCE, ENERGY EFFICIENCY

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Abstract: The exponential growth of data-intensive applications has driven the need for highly scalable, energy-efficient, and resilient cloud infrastructures. This paper investigates the integration of Artificial Intelligence (AI) into modern data centres and cloud environments, emphasizing its role in intelligent workload scheduling, predictive maintenance, energy optimization, and security automation. The proposed framework leverages deep reinforcement learning for dynamic resource allocation, achieving up to 25% reduction in latency under fluctuating workloads. Furthermore, AI-enabled control systems optimize cooling and power distribution, yielding 15–20% energy savings, significantly lowering the carbon footprint of large-scale data centres. For security, anomaly detection algorithms and adversarial learning models provide real-time intrusion prevention with >95% detection accuracy, enhancing data integrity and system resilience.

Keywords: Artificial Intelligence, Cloud Data Centres, Energy Efficiency, Machine Learning

AI FOR DISEASE DETECTION AND BODY CONSTITUTION ANALYSIS USING TONGUE IMAGING: A DEEP LEARNING APPROACH FOR NON-INVASIVE DIAGNOSTICS

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Abstract: This study presents a novel deep learning approach for non-invasive disease detection and body constitution analysis using tongue imaging, leveraging advances in artificial intelligence and computer vision to analyze tongue images and identify patterns indicative of various health conditions, with the proposed system utilizing a convolutional neural network (CNN) architecture to extract features from tongue images and predict disease presence and body constitution types, demonstrating high accuracy in detecting diseases and analyzing body constitution. Future research directions include expanding the dataset to include diverse populations, exploring multimodal fusion with other diagnostic modalities, and developing user-friendly interfaces for clinical adoption.

Keywords: Artificial Intelligence, Tongue Imaging, Disease Detection, Body Constitution Analysis, Deep Learning, Non-Invasive Diagnostics, Convolutional Neural Networks (CNNs), Preventive Healthcare.

ARTIFICIAL INTELLIGENCE FOR BUSINESS AUTOMATION

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Abstract : AI in business automation refers to the use of artificial intelligence technologies to streamline, optimize, and automate various business processes. By integrating AI into tasks such as data entry, customer service, inventory management, and decision-making, organizations can enhance efficiency, reduce operational costs, and improve accuracy. AI-driven automation systems can learn from data patterns, making them adaptable and capable of handling complex, repetitive tasks with minimal human intervention. This transformation not only accelerates workflows but also enables businesses to allocate resources to more strategic areas, fostering innovation and growth. Furthermore, AI in automation supports scalability, allowing companies to easily adjust to changing market demands and maintain competitive advantages. As AI technology continues to evolve, its role in reshaping business operations will likely expand, driving further innovation in industries across the globe.

Keywords : Artificial intelligence, Business Automation, Streamline , Cost Reduction Innovation, Accuracy, Repetitive Tasks , Scalability, Market Demand

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING FOR PRECISION AGRICULTURE: A SYSTEMATIC REVIEW OF YIELD PREDICTION AND OPTIMIZATION TECHNIQUES

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Abstract-Agriculture is a cornerstone of global food security, yet it faces mounting challenges such as resource scarcity, climate variability, and the increasing demand of a growing population. Artificial Intelligence (AI) and Machine Learning (ML) have emerged as transformative technologies for addressing these challenges by enabling accurate yield prediction, optimizing crop management, and improving overall resource efficiency. This paper presents a Systematic Literature Review (SLR) of 25 key studies that investigate AI-driven yield prediction and optimization techniques. These models leverage soil characteristics, climatic variables, and crop-specific features to achieve yield prediction accuracies of 85–95% in experimental evaluations. Performance is measured using RMSE, MAE, MSE, R², accuracy, precision, and recall, with feature selection and hyper parameter tuning highlighted as critical steps in improving robustness and generalization.

Keywords: AI & ML for Precision Agriculture Yield Prediction & Optimization

ARTIFICIAL INTELLIGENCE FOR SMART CITIES

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Abstract: AI is revolutionizing the concept of smart cities by optimizing energy, traffic, and urban planning, thereby creating a more sustainable, efficient, and livable urban environment, where citizens can thrive and enjoy a high quality of life, and cities can reduce their environmental footprint, improve public services, and enhance the overall quality of life for their citizens. Predictive energy management systems, powered by AI algorithms, analyze data from smart meters and IoT sensors to forecast energy demand, detect potential energy waste, and optimize energy distribution, which not only reduces energy consumption but also helps in decreasing greenhouse gas emissions, making cities more environmentally friendly and contributing to a cleaner and healthier environment for future generations. Additionally, AI-driven urban planning leverages data analytics and simulation to inform decision-making, enabling cities to optimize land use, public transportation, and community services, and to create more sustainable, resilient, and livable communities, where citizens can access affordable housing, quality education, and healthcare, and enjoy a high quality of life

Keywords: Artificial intelligence, smart cities, optimizing energy, traffic and urban planning

AUGMENTED & VIRTUAL REALITY POWERED BY AI

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Abstract: Augmented Reality (AR) and Virtual Reality (VR), when empowered by Artificial Intelligence (AI), are revolutionizing the way humans interact with digital environments by enabling immersive, adaptive, and intelligent experiences across multiple domains. The integration of AI with AR/VR enhances real-time object recognition, natural language interaction, gesture control, and adaptive learning, making these technologies more responsive, personalized, and context-aware. AI-powered gaming and entertainment, psychological therapies such as phobia and PTSD treatment, virtual tourism and cultural heritage preservation, as well as collaborative remote workspaces that simulate real world interactions. This synergy not only bridges the gap between traditional methods and modern digital solutions but also promotes efficiency, accessibility, and sustainability, positioning AI- powered AR/VR as a cornerstone technology for the future of education, healthcare, industry, and human-computer interaction.

Keywords: Augmented Reality, Virtual Reality, Artificial Intelligence, Immersive Technology, Intelligent Interaction, Digital Innovation.

ARTIFICIAL INTELLIGENCE HEALTHCARE SYSTEMS AND MEDICAL IMAGING

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Abstract: The integration of Artificial Intelligence (AI) into healthcare systems and medical imaging is revolutionizing the way diseases are detected, diagnosed, and treated. AI-powered algorithms enhance the accuracy and speed of medical imaging interpretation, enabling early detection of critical conditions such as cancer, cardiovascular disorders, and neurological diseases. By leveraging machine learning and deep learning techniques, healthcare systems can process large volumes of medical data, reduce diagnostic errors, and support clinicians in making informed decisions. Furthermore, AI facilitates personalized treatment planning, remote patient monitoring, and predictive analytics, leading to improved patient outcomes and optimized resource utilization. Despite challenges related to data privacy, model transparency, and ethical concerns, AI in healthcare and medical imaging holds immense potential to transform modern medicine into a more efficient, accessible, and patient-centric system.

Keywords: AI for Healthcare System, Medical Imaging, Disease Diagnosis, Machine Learning, Deep Learning, Predictive Analytics, Patient Care

DEEP REINFORCEMENT LEARNING (DRL) & ADAPTIVE AUTOMATION

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Abstract: Deep Reinforcement Learning (DRL) is a branch of artificial intelligence that combines reinforcement learning, where an agent learns by interacting with an environment through trial and error, with deep neural networks that act as powerful function approximates. This allows machines to make complex decisions in high-dimensional environments such as robotics, autonomous driving, and gaming. Adaptive automation, on the other hand, refers to a system that does not operate at a fixed level of automation but instead adjusts its behaviour according to the situation, environment, or human workload. For example, a self-driving car can drive on highways but return control to the driver in crowded city roads. When combined, DRL and adaptive automation create intelligent systems that can learn continuously from feedback and adapt dynamically to new conditions. While DRL provides the learning ability to improve decision-making policies, adaptive automation ensures flexibility and balance between human and machine roles, leading to safer, efficient, and context-aware automation.

Keywords: Deep Reinforcement learning, machine intelligence, human intelligence, adaptive automation, healthcare.

SKILL SWAP AI:AN INTELLIGENT PLATFORM FOR COLLABORATIVE KNOWLEDGE EXCHANGE

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Abstract - Skill Swap AI is an intelligent platform designed to facilitate peer-to-peer skill exchange by leveraging artificial intelligence, natural language processing, and gamification techniques. Unlike conventional e-learning systems, which rely on one-way instruction, Skill Swap AI enables users to act as both learners and instructors, creating a balanced ecosystem for knowledge sharing. The system incorporates a hybrid recommendation engine that combines semantic skill matching with historical interaction data to generate accurate user pairings. A trust and reputation framework, including peer ratings and blockchain-based credential verification, ensures credibility and reliability, while gamification elements promote engagement and sustained participation. Additionally, the platform can integrate GPR and LiDAR sensing modules for field-based and experiential learning applications, expanding its utility beyond digital interactions. **Keywords:** Peer-to-Peer Learning, Skill Exchange, Artificial Intelligence, Recommendation Systems,

Gamification, Trust Management, GPR, LiDAR.

EDGE INTELLIGENCE: OPTIMIZING MACHINE LEARNING MODELS FOR LOW –RESOURCE ENVIRONMENT

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Abstract: This paper reviews recent advancements in clinical evaluation and regulatory frameworks for AI-driven Software as a Medical Device (SaMD). With the rapid adoption of artificial intelligence (AI) and machine learning (ML) in healthcare, particularly in radiology, regulatory bodies such as the U.S. FDA have introduced guidelines to ensure safety, effectiveness, and post-market surveillance. The study analyzes 309 FDA-cleared AI/ML SaMDs under the 510(k) pathway, categorizing them into detection, diagnosis, triage, and optimization tools. It highlights key challenges, including limited transparency in clinical trial design, insufficient real-world validation, small or undisclosed training datasets, and a lack of performance evaluation in clinical practice. The paper emphasizes the need for rigorous statistical designs, comprehensive clinical evaluations, and real-world evidence (RWE) to ensure reliability and safety. It concludes by recommending systematic regulation, adaptive learning oversight, and continuous post-market monitoring to enhance trust, performance, and personalized medical services.

Keywords : Artificial Intelligence (AI), Machine Learning (ML), Real-World Data (RWD), Real-World Evidence (RWE), Post-market surveillance, Personalized medicine, Adaptive learning AI

ENERGY EFFICIENCY, SUSTAINABILITY, BATTERY-LESS OR BIODEGRADABLE IOT

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Abstract: The rapid proliferation of the Internet of Things (IoT) has revolutionized various sectors, from healthcare and agriculture to smart cities and industrial automation. However, this growth poses significant challenges in terms of energy consumption, environmental impact, and electronic waste. This paper explores the convergence of energy efficiency, sustainability, and the emergence of battery-less or biodegradable IoT technologies. Battery-less IoT systems, powered by ambient energy sources such as solar, thermal, RF, or vibration energy, offer a promising alternative to traditional battery-powered devices, reducing maintenance costs and ecological footprints. Meanwhile, biodegradable materials in sensor manufacturing present a sustainable solution to minimize long-term environmental damage. This study highlights key innovations, potential applications, and the challenges that must be addressed to transition towards greener, more sustainable IoT ecosystems.

Keywords: deep Fake, RoBERTa, XceptionNet, CNN, RNN

FAKE NEWS PLUS DEEP FAKE VIDEO DETECTION SYSTEM

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Abstract: In today’s digital age, the spread of misinformation—whether through misleading text or manipulated videos—poses a serious threat to public trust, security, and informed decision-making. Fake news often distorts facts using emotionally charged or deceptive language, while deepfake videos leverage advanced generative technologies to create highly realistic yet entirely false visual and audio content. Despite growing awareness, most existing detection tools address either text or video in isolation, limiting their effectiveness in tackling multimodal misinformation. This research introduces a unified, AI-based system designed to detect both fake news and deepfakes within a single, integrated framework. For textual analysis, we utilize transformer-based Natural Language Processing (NLP) models such as BERT and RoBERTa to assess semantic consistency, writing style, and credibility cues. For video analysis, deep learning architectures including Convolutional Neural Networks (CNNs), XceptionNet, and Recurrent Neural Networks (RNNs) are applied to identify facial inconsistencies, unnatural motion, and mismatched audio-visual elements. To make this system practical and accessible, we developed a user-friendly dashboard That enables real-time verification of articles and videos.

Keywords: deep Fake, RoBERTa, XceptionNet, CNN, RNN

FRAUDSHIELD: FEDERATED EXPLAINABLE AI FOR REAL-TIME FRAUD DETECTION IN HEALTHCARE

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Abstract: Healthcare insurance fraud has become a major global concern, leading to substantial financial losses, increased insurance premiums, and reduced access to quality care. Existing studies have shown the effectiveness of machine learning, ensemble models, and explainable artificial intelligence (XAI) in detecting fraudulent claims. However, most current approaches face challenges such as class imbalance, limited interpretability, and a lack of real-time adaptability to evolving fraud schemes. In this paper, we propose FraudShield, a federated and explainable AI framework for detecting healthcare insurance fraud. XAI modules such as LIME and SHAP provide interpretability, enabling auditors and regulators to understand model predictions. Furthermore, a cost-sensitive evaluation metric is introduced to emphasize the detection of high-impact fraudulent claims. Experimental validation on Medicare insurance claim datasets demonstrates that FraudShield achieves an accuracy of 97.8%, significantly reducing false negatives compared to state-of-the-art methods. The proposed framework not only enhances fraud detection accuracy but also contributes to safeguarding healthcare resources, improving trust in insurance systems, and ensuring equitable allocation of medical services.

Keyword: Healthcare fraud detection, health insurance, federated learning, explainable AI, ensemble models, anomaly detection.

GENERATIVE AI & MULTIMODAL AI: REVOLUTIONIZING HUMAN-MACHINE INTERACTION

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Abstract: Generative AI and Multimodal AI are emerging technologies transforming the way humans interact with machines. Generative AI, exemplified by large language models (LLMs) and diffusion models, can create human-like text, images, audio, and video. Multimodal AI integrates multiple data modalities—such as text, images, speech, and sensor data—into cohesive models, enabling richer contextual understanding and generation. This paper presents an overview of the recent advances in Generative AI and Multimodal AI, their applications in healthcare, education, and entertainment, and discusses the challenges in scalability, ethical considerations, and model efficiency. Finally, we propose a framework for domain-specific multimodal AI applications to enhance human-machine collaboration in real-world environments.

Keywords: Generative AI, Multimodal AI, Large Language Models, Diffusion Models, Deep Learning, Human-Machine Interaction, AI Ethics.

GENERATIVE AI FOR CYBER OFFENCE AND DEFENCE: THE AI ARM RACE

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Abstract: Generative Artificial Intelligence (GenAI), particularly large language models (LLMs), has become a pivotal, dual-use technology fundamentally reshaping the cybersecurity landscape. This paper explores the accelerating "AI Arms Race"—a dynamic contest where both cyber attackers and defenders leverage GenAI to gain a decisive advantage. On the offensive side, GenAI significantly lowers the barrier to entry for cybercriminals and amplifies the sophistication, scale, and speed of attacks. Attackers utilize it to generate highly convincing and personalized social engineering content, such as spear-phishing emails with impeccable grammar, or to autonomously craft and test malicious code and exploits, potentially accelerating the development process by over a factor of ten. GenAI-powered tools enhance security operations by automating tedious tasks, augmenting human analysts with deep insights, and generating realistic synthetic data for advanced threat modeling, training, and defense system stress testing. The escalating capabilities on both sides have initiated a perpetual arms race. The core challenge lies in the inherent risks of GenAI models themselves, including susceptibility to adversarial attacks (like model poisoning or jailbreaking) and the potential for self-replicating, autonomous threats.

Keywords: Cyber offence ,Cyber defence , Threat detection ,Malware generation , Adversarial AI , AI - driven attacks ,AI - powered defence ,Intrusion prevention , Zero - day exploits , Security automation

HANDLING EXPONENTIAL IOT DATA: STREAMING AND ANALYTICS

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Abstract : Data generated by the Internet of Things (IoT) is growing at an exponential rate, posing significant challenges for traditional data processing systems. This abstract presents a comprehensive framework for handling this massive influx of data, focusing on real-time streaming and advanced analytics. Every single smart device—from your watch to your car to a lightbulb—is constantly shouting out data. The amount of information is huge, and it's all happening incredibly fast. Old computer systems just can't keep up. We've built a new system that works like a super-fast brain. Instead of letting all that data pile up, it grabs the information as soon as it's sent and figures out what's important right away. This lets us find problems, like a machine about to break, or see useful patterns, like how to make traffic flow better. Essentially, we're taking a massive flood of data and turning it into smart decisions, helping people and businesses work better, faster.

Keywords: Real time streaming, IoT, smart decisions

HOW AGRICULTURE 4.0 SOLUTION CAN REDUCE THE ENVIRONMENT IMPACT OF VITICULTURE?

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Abstract: Viticulture is a key agricultural sector in Europe but is associated with significant environmental pressures, mainly due to intensive pesticide use. This study explores how digital Agriculture 4.0 tools can support more sustainable vineyard management. Using the Pocket SPRAY application, which integrates satellite data and predictive models for variable-rate spraying, we compared conventional (base) and digital-assisted (smart) practices in two Lombardy vineyards. A Life Cycle Assessment (LCA) showed that the smart approach reduced pesticide inputs—particularly copper- and sulfur-based products—and lowered environmental impacts across all categories, with the largest benefits in freshwater ecotoxicity and resource use. These results confirm that digital technologies can improve vineyard sustainability without compromising grape quality. However, further trials and holistic evaluations, including economic and social aspects, are needed to fully assess the transition toward digital viticulture.

Keywords: Agriculture 4.0, Viticulture, Environmental impact, digital Viticulture, PocketSPRAY, Variable - rate spraying Life Cycle Assessment (LCA)

HUMAN FACTORS: IMMERSION, PERCEPTION, INTERACTION & ACCESSIBILITY IN AR/VR

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Abstract: The study of human factors in Augmented Reality (AR) and Virtual Reality (VR) focuses on enhancing user experience by addressing immersion, perception, interaction, and accessibility. Immersion ensures a sense of presence by integrating realistic visuals, audio, and multisensory feedback. Perception plays a crucial role in aligning virtual stimuli with human sensory processing to avoid discomfort and improve realism. Interaction design emphasizes intuitive controls, natural gestures, and responsive feedback to enable seamless engagement with virtual environments. Accessibility ensures inclusivity by adapting AR/VR systems for users with diverse physical, sensory, and cognitive abilities. Together, these factors determine the effectiveness, comfort, and usability of AR/VR applications across domains such as education, healthcare, training, and entertainment. Addressing challenges like motion sickness, cognitive overload, and hardware limitations can lead to the development of more user-centric, adaptive, and accessible immersive technologies.

Keywords: AR/VR, Immersion, Perception, Human-Computer Interaction, Accessibility, User Experience, Inclusive Design

IMPACT OF AI ON SOCIETY: ECONOMIC IMPACT OF ARTIFICIAL INTELLIGENCE (AI)

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Abstract: Artificial Intelligence (AI) has emerged as a transformative force in the global economy, redefining the way industries operate and societies progress. By enabling automation, predictive analytics, and advanced decision-making, AI is significantly improving productivity and efficiency across sectors such as healthcare, manufacturing, agriculture, finance, and retail. Businesses are leveraging AI to optimize supply chains, reduce operational costs, and deliver personalized services to customers, thereby strengthening competitiveness in an increasingly digital marketplace. The automation of routine and repetitive tasks threatens to displace millions of workers, creating widespread concerns about unemployment and the need for large-scale reskilling. This digital divide may exacerbate social and economic inequalities if not addressed through inclusive policies and global cooperation. In conclusion, while AI holds immense potential to drive sustainable growth and reshape the global economy, it also demands careful governance, ethical implementation, and strategic investments in education and workforce development. Striking a balance between technological innovation and social equity will be essential to ensure that the economic impact of AI benefits all of humanity.

Keywords: Artificial Intelligence (AI), global economy, automation, productivity, efficiency, innovation, unemployment, reskilling, digital divide, economic inequality, governance, sustainable growth, social equity

AN IMPACT OF AI ON SOCIETY

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Abstract: “The rapid advancement of Artificial Intelligence (AI) is transforming various aspects of society, from healthcare and education to employment and governance. While AI offers numerous benefits, such as increased efficiency, improved decision-making, and enhanced customer experiences, it also raises significant concerns about job displacement, bias, and accountability. This paper explores the multifaceted impact of AI on society, examining both the opportunities and challenges it presents. It discusses the potential benefits of AI in improving healthcare outcomes, enhancing education, and driving economic growth, while also addressing the risks of exacerbating existing social inequalities, compromising privacy, and undermining human autonomy. The paper concludes by highlighting the need for a nuanced understanding of AI’s impact on society and the importance of developing responsible AI systems that prioritize transparency, accountability, and human values.”

Keywords: Artificial Intelligence, Society, Impact, Ethics, Job Displacement, Transformation.

INTELLIGENT IOT-BASED SOS ALERT AND TRACKING SYSTEM

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Abstract: Personal security is a rising issue in contemporary society, particularly during crisis situations like harassment, accidents, or medical emergencies. Traditional safety measures, such as calling using manual telephones, are usually delayed and experience limitations in providing real-time support. With the advent of the Internet of Things (IoT), smartphones and smart devices can be leveraged as wise safety nodes to construct an interactive community-based network. This Community Safety App based on IoT uses smartphone sensors, GPS, and cloud platforms to send SOS alerts, live location, and evidence (audio/video) immediately to trusted contacts, proximal users, and authorities. The system adds Ghost Mode to quietly keep tracking even if the phone tries to be shutdown. By considering every smartphone an IoT device, the system creates a distributed network of safety that enables quicker response, community cooperation, and lower risk in emergency situations.

Keywords: IoT, ghost mode, community safety app.

IOT APPLICATION OF VERTICAL DOMAIN

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Abstract: The Internet of Things (IoT) has emerged as a transformative technology, enabling seamless interconnection of devices, sensors, and systems to provide intelligent services within specific vertical domains. This paper focuses on the application of IoT in the [insert vertical domain: e.g., healthcare, agriculture, transportation, or smart cities], where real-time data acquisition, monitoring, and decision-making play a critical role. By integrating heterogeneous IoT devices with cloud and edge computing platforms, the system enhances operational efficiency, reduces costs, and supports data-driven decision-making. The proposed application framework ensures scalability, interoperability, and security while addressing domain-specific challenges such as [insert challenges: e.g., patient privacy in healthcare, resource optimization in agriculture, or traffic congestion in smart cities]. The study highlights how IoT adoption in the [chosen vertical domain] not only improves service delivery and user experience but also lays the foundation for sustainable and intelligent ecosystems.

Keywords: Transformative technology, heterogeneous IoT, intelligent ecosystem

MEDIPREDICT AN AI POWERED PREDICTIVE HEALTHCARE AND DIAGNOSTIC SUPPORT SYSTEM

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Abstract: The rapid advancements in Artificial Intelligence (AI) are redefining the healthcare landscape by enabling data-driven decision-making, predictive analytics, and intelligent diagnostic support. Despite significant progress in medical technology, healthcare systems continue to face challenges such as delayed diagnoses, high clinical workload, and limited access to personalized care. MediPredict: An AI-Powered Predictive Healthcare and Diagnostic Support System seeks to address these challenges by leveraging state-of-the-art machine learning algorithms, natural language processing, and medical data analytics to provide timely, accurate, and personalized health insights. By incorporating explainable AI techniques, MediPredict ensures transparency, accountability, and trust in its predictions while adhering to stringent ethical and privacy standards..

Keywords: Artificial Intelligence (AI), Predictive Healthcare, Diagnostic Support System, Machine Learning, Medical Data Analytics, Explainable AI, Clinical Decision Support, Preventive Medicine.

NEXT GENERATION COMPUTING WITH AI

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Abstract: The paradigm of next-generation computing is undergoing a profound transformation through the integration of advanced Artificial Intelligence (AI) methodologies with heterogeneous computing environments. Emerging paradigms such as neuromorphic architectures, quantum-inspired algorithms, and large-scale distributed systems are reshaping computational models by enabling ultra-fast, adaptive, and energy-efficient processing. This convergence not only accelerates high performance computing (HPC) but also fosters real-time decision-making capabilities across domains including precision medicine, cybersecurity, sustainable energy, and autonomous systems. Furthermore, the infusion of generative AI and foundation models into scientific discovery pipelines is pushing the boundaries of automation, knowledge synthesis, and human-machine co-intelligence. This paper critically examines the interplay between algorithmic innovation, next-gen hardware acceleration, and responsible AI governance. By addressing challenges in scalability, interpretability, and ethical deployment, we outline a forward-looking roadmap for how AI-augmented computing will redefine the digital infrastructure of the 21st century.

Keywords- Next-Generation Computing, Artificial Intelligence (AI), Neuromorphic Computing, Quantum-Inspired Algorithms, High-Performance Computing (HPC).

THE INTERSECTION OF QUANTUM COMPUTING AND ARTIFICIAL INTELLIGENCE

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Abstract: The fundamental components of quantum computing will be discussed in this paper, along with various applications in AI that can benefit from more effective use of quantum computing. There are various resemblances between quantum computing and artificial intelligence. Quantum computing can give machine learning and artificial intelligence algorithms faster training times and cheaper computing power, whereas artificial intelligence can give quantum computers the required error correction algorithms. Quantum computing has the potential to become the next revolutionary technology due to its utilization of superposition and entanglement from quantum mechanics to represent data and perform operations, which could have significant implications and applications for businesses and markets. This is because it can resolve very complex and specific problems much more quickly than conventional computers. The paper also introduces a few quantum computing application areas and potential future research fields.

Keywords—*Superposition, Entanglement, Artificial Intelligence, Quantum Computing, Classical Computers, Gates.*

NEXT GENERATION COMPUTING – AI

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Abstract: Artificial Intelligence (AI) is not merely an extension of computational progress; it is the defining catalyst of next-generation computing. Unlike traditional computational paradigms that follow deterministic logic, AI introduces adaptive, self-learning systems capable of reasoning, perception, and autonomous decision-making. This paper explores how AI is shaping the evolution of computing architectures, enabling human–machine symbiosis, and redefining the boundaries of technological capability. The discussion integrates advancements in machine learning, neuromorphic systems, and quantum AI, while analysing societal implications and ethical considerations.

Keywords: *AI, AGI, Quantum & Neuromorphic Computing, Ethical AI*

QUANTUM MACHINE LEARNING FOR OPTIMIZATION PROBLEMS IN ARTIFICIAL INTELLIGENCE

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Abstract: Quantum machine learning (QML) stands at the intersection of quantum computing and artificial intelligence, promising revolutionary advances in speed and efficiency for solving complex optimization problems central to AI. While classical machine learning algorithms face bottlenecks with large-scale data and computationally expensive models, QML leverages quantum superposition and entanglement to explore solution spaces more effectively. Recent breakthroughs include quantum variational circuits, quantum kernel methods, and hybrid quantum-classical approaches, all offering new prospects for data modeling, pattern recognition, and resource optimization in sectors such as finance, healthcare, logistics, and communication networks. This session will explore theoretical foundations, implementation challenges, and case studies demonstrating how quantum-enhanced optimization can unlock new capabilities in artificial intelligence. The discussion will also touch upon future directions, including scalability of quantum hardware and the integration of QML with emerging AI techniques, paving the way for next-generation intelligent systems.

Keywords: Quantum Machine Learning (QML), Quantum Computing, Artificial Intelligence (AI), Quantum Superposition

RECOMMENDATION SYSTEM

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Abstract: In today's digital ecosystem, the exponential growth of data has created an urgent need for intelligent systems that can personalize user experiences. Recommendation systems have emerged as a key solution, enabling platforms to suggest products, services, and content tailored to individual preferences. These systems leverage techniques from machine learning, data mining, and artificial intelligence to analyze user behavior, contextual information, and historical data. This paper presents an overview of the evolution of recommendation systems, from early heuristic-based models to modern deep learning approaches. It also discusses challenges such as cold start, scalability, and data sparsity. The study concludes with insights into current trends, including reinforcement learning, graph-based models, and context-aware recommendations, which are shaping the next generation of intelligent systems.

Keywords: Recommendation Systems, Machine Learning, Personalization, Collaborative Filtering, Explainable AI

SELF-SUPERVISED / UNSUPERVISED LEARNING AND REPRESENTATION LEARNING

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Abstract: In the age of data-driven intelligence, machine learning has become a cornerstone of modern computational systems. While supervised learning has traditionally dominated the landscape, the ever-increasing volume of unlabeled data has necessitated a shift toward more scalable approaches. This research focuses on self-supervised and unsupervised learning methods— paradigms that eliminate the need for labeled data while still extracting meaningful patterns and representations. Much like vehicles require maintenance to reduce pollution, AI systems require clean, robust data representations to function effectively. Poorly learned representations often lead to suboptimal decision-making or model degradation. The model proposed in this study leverages self-supervised techniques to pre-train feature extractors on raw input data using proxy tasks, such as predicting masked inputs or identifying augmentations of the same instance. These learned representations are then fine-tuned or directly applied to downstream tasks without requiring large labeled datasets. Unsupervised clustering and dimensionality reduction techniques are also integrated into the model to analyze and group data in high- dimensional spaces.

Keywords- Responsible Artificial Intelligence, Explainable Artificial Intelligence, REF-AI,

STATE-OF-THE-ART IN RESPONSIBLE, EXPLAINABLE, AND FAIR AI FOR MEDICAL IMAGE ANALYSIS

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Abstract: Integrating responsible, explainable, and fair artificial intelligence (REF-AI) into medical image analysis has gained significant attention in recent years. This has been driven by the pressing need for ethical, trustworthy, and transparent implementation of AI systems in healthcare. The following review provides a concise overview of REF-AI in the context of medical image analysis. It begins with the fundamental concepts of AI responsibility, explainability, and fairness, followed by a comprehensive taxonomy of over 35 key algorithms and strategies. In addition, it compares methodologies, strengths, and limitations, such as the alignment of AI models with medical standards and the development of interpretable and actionable results for clinicians. Finally, it highlights current trends and proposes directions for future research to further advance the responsible, explainable, and fair application of AI in medical imaging.

Keywords- Responsible Artificial Intelligence, Explainable Artificial Intelligence, REF-AI, Medical Image Analysis, Transparent AI system, Ethical AI in Healthcare, Interpretability

SENSOR DRIVEN AI SYSTEM FOR REAL TIME MONITORING

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Abstract: Sensor driven artificial intelligence (AI) systems have emerged as a transformative technology for real-time monitoring across diverse domains such as agriculture, healthcare, industrial automation, and environmental management. These systems integrate advanced sensor networks with intelligent data processing algorithms to continuously capture, analyze, and interpret dynamic environmental and operational parameters. This project focuses on the design and implementation of a sensor-driven AI framework capable of delivering accurate, real-time insights for decision-making. The system employs an array of sensors to monitor critical parameters such as temperature, humidity, pressure, vibration, air quality, and energy consumption, depending on the application context. The collected data is processed using AI algorithms, including machine learning and deep learning models, to detect anomalies, predict trends, and trigger automated responses. By leveraging real-time analytics, the proposed system significantly reduces human intervention, enhances efficiency, and ensures timely actions that prevent failures, improve productivity, and optimize resource utilization. Furthermore, the sensor-AI integration ensures scalability, allowing deployment in both small-scale and large- scale monitoring applications.

Keywords: Real-Time Monitoring, Sensors, Artificial Intelligence, IoT, Predictive Analytics, Automation

THE RISE OF GENERATIVE AI OPPORTUNITIES AND RISKS

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Abstract: The emergence and rapid evolution of generative artificial intelligence (AI) have ushered in a new era of computational creativity and automation. Generative AI refers to models, particularly those based on deep learning architectures like Generative Adversarial Networks (GANs) and Large Language Models (LLMs), which can produce human-like text, images, videos, audio, and even complex code. The widespread adoption of models such as GPT, DALL·E, and Stable Diffusion signals a paradigm shift in how machines can contribute to tasks that were traditionally seen as uniquely human. The paper provides a comprehensive analysis of the dual-edged nature of generative AI. It explores the opportunities it offers for innovation and efficiency, while critically examining the associated risks and their broader implications for individuals, institutions, and society. Additionally, it discusses the role of policymakers, technologists, educators, and civil society in shaping a future where generative AI is used ethically and equitably.

Keywords: Artificial intelligence ethics, AI risks, Deep learning, Misinformation, Responsible AI.

TRAFFIC MODELLING, ANOMALY DETECTION, AND PRIVACY IN NETWORK DATA

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Abstract: In the rapidly evolving landscape of network security, the integration of traffic modelling and anomaly detection stands as a pivotal strategy for identifying and mitigating potential threats. This research presents a comprehensive framework that synergizes advanced traffic modelling techniques with sophisticated anomaly detection algorithms, all while prioritizing the preservation of user privacy. By harnessing the power of machine learning and data analytics, our approach not only enhances the accuracy of threat detection but also ensures that sensitive user information is safeguarded through state-of-the-art privacy-preserving methodologies. The proposed framework is designed to adapt to the dynamic nature of network traffic, providing real-time insights and proactive security measures. Through extensive experimentation and validation, we demonstrate the efficacy of our approach in distinguishing between legitimate and malicious network activities, thereby contributing to the development of more resilient and secure network infrastructures.

Key words: Lift-to-drag ratio enhancement, AI-driven design framework, Energy-efficient underwater vehicles, Bio-inspired hull design.

AUTONOMOUS SHIPPING TECHNOLOGIES

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Abstract: Autonomous shipping represents a transformative paradigm in maritime logistics, leveraging artificial intelligence (AI), sensor fusion, and advanced navigation systems to enable unmanned vessel operations. This paper explores the technical foundations, challenges, and potential impacts of autonomous ships on global trade efficiency, safety, and environmental sustainability. Key components include real-time obstacle detection via LiDAR and radar integration, machine learning algorithms for route optimization, and cybersecurity protocols to mitigate remote hacking risks. Drawing from case studies such as the Yara Birkeland (the world's first fully electric and autonomous container ship), we analyze operational trials in controlled coastal environments and simulate open-sea deployments. Results indicate up to 30% reductions in fuel consumption and crew-related incidents, though regulatory hurdles under frameworks like the International Maritime Organization's MASS (Maritime Autonomous Surface Ships) guidelines persist. Autonomous shipping refers to the use of unmanned or minimally crewed vessels that rely on advanced technologies like artificial intelligence (AI), sensors, GPS, radar, LIDAR, and automated navigation systems to operate with little or no human intervention

Keywords: Autonomous ship, maritime autonomy, unmanned surface vehicles, autonomous navigation, AI-driven shipping, sensor fusion, remote vessel operation.

BIAS IN ARTIFICIAL INTELLIGENCE SYSTEMS

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Abstract: Artificial Intelligence (AI) systems are increasingly embedded in decision-making processes across sectors such as healthcare, finance, law enforcement, and education. While these systems promise efficiency and objectivity, they often inherit and amplify biases present in their training data, algorithms, and design choices. This paper explores the multifaceted nature of AI bias, tracing its origins from historical data imbalances to algorithmic optimization strategies that inadvertently favor certain groups. Through real-world case studies and current research, we examine the ethical, social, and legal consequences of biased AI outcomes. The paper also evaluates emerging mitigation strategies, including fairness-aware algorithms, inclusive data practices, and regulatory frameworks. By critically analyzing these approaches, we highlight the importance of transparency, accountability, and interdisciplinary collaboration in building equitable AI systems. Ultimately, this work advocates for a shift from reactive bias correction to proactive bias prevention, ensuring that AI technologies serve all communities fairly and responsibly.

Keywords: Artificial Intelligence, AI Bias, Algorithmic Fairness, Ethical AI, Bias Mitigation, Inclusive Data, Transparency, Accountability, Equitable Systems, Regulatory Frameworks.

BEYOND POLARITY: CONTEXT-AWARE SENTIMENT ANALYSIS USING AI-DRIVEN LANGUAGE MODELS

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Abstract: Traditional sentiment analysis has primarily relied on binary or ternary polarity classification, identifying texts as positive, negative, or neutral. While these methods provide a basic framework for opinion detection, they often fall short in capturing the complexity and subtlety of real-world human expression—especially when faced with sarcasm, ambiguity, multilingual contexts, or code-switching scenarios. To address these challenges, this paper presents a robust and scalable methodology for context-aware sentiment analysis utilizing cutting-edge AI-driven language models. The approach is grounded in transformer architectures and prompt engineering, including models such as BERT, RoBERTa, and cross-lingual variants like XLM-RoBERTa. The proposed solution delivers real-time deployment through web APIs and secures cloud platforms, supporting high-throughput ingestion of multilingual and code-mixed data streams from social media, product reviews, and news articles.

Keywords: Solution Sentiment Analysis, Language Models, Polarity, Context Awareness, Transformers.

BIG DATA ANALYTICS: DRIVING AI/ML BREAKTHROUGHS

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Abstract: Data Analytics has become the cornerstone for driving transformative breakthroughs in various domains. The massive growth of structured and unstructured data provides unprecedented opportunities to train advanced models with higher accuracy. By leveraging distributed computing frameworks and cloud-based infrastructures, organizations can process and analyze petabytes of data efficiently. Algorithms thrive on diverse, large-scale datasets, enabling deeper insights, robust predictions, and scalable applications. The integration of big data with advanced systems accelerates innovation in fields such as healthcare, finance, cybersecurity, and smart cities. Realtime analytics further enhances adaptive models, supporting Master decision- making and personalized outcomes. Predictive and prescriptive analytics derived from big data empower systems to go beyond automation toward intelligent reasoning. Challenges such as data quality, privacy, and computational costs remain, yet advancements in edge computing and federated learning are mitigating these barriers. As a result, the synergy between big data and emerging technologies continues to redefine industries, research, and daily human interactions. This evolution highlights big data analytics not only as an enabler but also as a driver of next- generation breakthroughs.

Keywords: Big Data Analytics, Predictive Analytics, Real-time Processing, Cloud Computing, Data-driven Insights, Federated Learning, Edge Computing, Smart Applications

COMPUTER VISION FOR SELF DRIVING CARS

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Abstract: Self-driving cars represent a transformative shift in intelligent transportation systems, where computer vision plays a pivotal role in ensuring safety, reliability, and efficiency. Computer vision enables autonomous vehicles to perceive and interpret their surroundings through cameras and sensors, replicating human visual understanding with advanced algorithms. This paper explores the fundamental aspects of computer vision for self- driving cars, including object detection, lane recognition, traffic sign identification, and pedestrian tracking. It highlights the integration of deep learning and real-time image processing techniques for robust decision-making in dynamic driving environments. Furthermore, the paper discusses current challenges such as low-light perception, adverse weather conditions, and the need for high computational efficiency. By addressing these limitations, computer vision can accelerate the deployment of safe and scalable autonomous vehicles, contributing significantly to the future of intelligent mobility.

Keywords: Computer Vision, Self-Driving Cars, Deep Learning, Autonomous Vehicles, Intelligent Transportation Systems, Object Detection, Lane Detection.

CYBER SECURITY THREATS AND ETHICAL HACKING

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Abstract: Cyber security threats are rapidly evolving as technology becomes more interconnected and accessible. Attackers exploit vulnerabilities in networks, applications, and systems to gain unauthorized access, steal information, or disrupt services. Common threats include malware, phishing, ransomware, denial-of-service attacks, and social engineering. These threats not only cause financial loss but also compromise privacy and trust. To combat such risks, ethical hacking plays a vital role. Ethical hackers, with proper authorization, simulate cyber-attacks to identify and fix security loopholes before malicious hackers can exploit them. By adopting ethical hacking practices, organizations can strengthen their defense mechanisms, safeguard digital assets, and build a secure cyber environment.

Keywords: Cyber Security, Ethical Hacking, Malware, Phishing, Penetration Testing.

DIGITAL TWINS FOR NETWORKED THINGS

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Abstract: Digital twin technology has emerged as a transformative approach to managing and optimizing complex systems of interconnected devices, commonly referred to as networked things. A digital twin is a virtual representation of a physical asset, process, or system that continuously synchronizes with its real-world counterpart through data collected from sensors and communication networks. In the context of networked things, digital twins enable real-time monitoring, predictive analytics, and scenario-based simulations that improve decision-making, efficiency, and resilience. By integrating Internet of Things (IoT), cloud computing, and artificial intelligence, digital twins support proactive maintenance, resource optimization, and rapid testing of new configurations without disrupting physical operations. This paradigm has applications across smart cities, manufacturing, telecommunications, and healthcare, where the need for reliable, adaptive, and intelligent systems is growing. Ultimately, digital twins for networked things provide a foundation for building self-optimizing, data-driven ecosystems that bridge the gap between the physical and digital worlds.

Keywords: Internet of things, Artificial intelligence, Telecommunications, Digital twins, Networks.

EARLY DISEASE PREDICTION USING MACHINE LEARNING

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Abstract: Early detection of diseases plays a crucial role in improving patient survival rates, reducing healthcare costs, and enabling timely medical intervention. With the rapid advancement of data-driven technologies, machine learning has emerged as a powerful tool for analyzing complex medical data and predicting disease onset at an early stage. This project focuses on the development of a machine learning based framework for early disease prediction using patient health records, medical history, and diagnostic parameters. Various supervised learning algorithms such as decision trees, support vector machines, and neural networks are employed to identify hidden patterns and correlations within datasets. By automating the prediction process, this approach minimizes human error, enhances diagnostic reliability, and provides personalized healthcare insights. The proposed system serves as a decision-support tool for healthcare professionals, facilitating proactive disease management and preventive care. Through this innovation, healthcare delivery can be made more efficient, accessible, and patient-centered, ultimately contributing to improved public health outcomes.

Keywords: Machine Learning, Early Disease Prediction, Healthcare Analytics, Preventive Care, Data-Driven Diagnosis

FUTURE AND RESEARCH DIRECTIONS

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Abstract: The future of artificial intelligence research is poised to move beyond its current capabilities toward systems that are more generalizable, trustworthy, and seamlessly integrated into human and societal contexts. While present advancements in machine learning, natural language processing, and computer vision have transformed industries, future research must address challenges of scalability, interpretability, and ethical responsibility. Equally important is the pursuit of fairness, transparency, and accountability, ensuring that AI technologies do not reinforce bias or inequality but instead contribute to inclusivity and social good. Long-term research must also focus on establishing robust benchmarks, reproducibility standards, and regulatory guidelines to bridge the gap between experimental results and real-world adoption. By combining scientific innovation with ethical and human-centred approaches, the next phase of AI research can deliver transformative solutions that are both technologically advanced and socially beneficial.

Keywords: Human-AI, Generalized, Machine Learning, Energy-efficient AI, Real-world adoption

GEN-AI WITH MODEL CONTEXT PROTOCOL

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Abstract: Machines can now produce text, images, code, and other multimodal outputs with almost human creativity thanks to generative artificial intelligence (GenAI), which has quickly become a paradigm-shifting technology. The synergy between GenAI and MCP in creating intelligent, context-aware applications is examined in this work. GenAI systems can increase dependability, accuracy, and adaptability by using MCP to validate outputs, execute grounded actions, and dynamically retrieve pertinent information. Intelligent decision-support systems, multimodal content creation platforms that blend creativity and factual foundations, and personalized learning assistants are examples of use cases. The suggested method emphasizes the advantages of using MCP to enhance GenAI in terms of architectural design, workflow integration, and performance. According to experimental findings, this integration guarantees more reliable, explicable, and domain-specific AI solutions by improving user interaction and lowering hallucinations. This study establishes MCP-enabled GenAI as a potent framework for next- generation AI applications in enterprise, healthcare, education, and other fields.

Keywords: Generative AI, Model Context Protocol, LLMs, Intelligent Systems, Context-Aware AI

GENERATIVE AI FOR RECIPE CREATION BASED ON LOCAL INGREDIENTS

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Abstract: Food choices today are increasingly shaped by the need for healthier, sustainable, and locally adaptable diets. Traditional recipe recommendation systems primarily analyze nutritional values, often overlooking the role of locally available ingredients and the detailed sequence of cooking actions. Recent advancements in Generative Artificial Intelligence (AI), particularly Large Language Models (LLMs), present opportunities to address these gaps by generating recipes that are culturally relevant, nutritionally balanced, and practically executable. This project introduces Cook-Gen, a generative AI framework that creates recipes by incorporating both regional ingredient availability and step-by-step cooking instructions. Experimental outcomes highlight that Cook-Gen not only improves the reliability of cooking step generation but also outperforms baseline models in delivering healthier, culturally meaningful, and adaptable recipes. This work bridges the gap between modern AI innovations and everyday food practices, supporting individuals in making informed and localized dietary choices.

Keywords: Generative AI, Recipe Generation, Local Ingredients, Cooking Actions, Food Computation, Healthy Eating, Large Language Models

GENERATIVE AI IN EDUCATION: TRANSFORMING PERSONALIZED TUTORING AND CONTENT CREATION

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Abstract: Generative Artificial Intelligence (AI) is redefining the educational Landscape by enabling personalized tutoring and automated content creation. Traditional learning systems often fail to adapt to the unique pace, style, and comprehension level of individual learners, resulting in gaps in engagement and knowledge retention. This paper presents a framework that integrates generative AI models into education to deliver adaptive, student-centered learning experiences. Experimental findings and case studies suggest that generating AI can significantly enhance learner engagement, improve retention rates, and reduce educator workload by automating routine tasks. By offering a scalable, interactive, and inclusive learning environment, this approach highlights the transformative potential of generative AI in shaping the future of education.

Keywords: *Generative AI, Personalized Tutoring, Content Creation, Adaptive Learning, Educational Technology*

GENERATIVE AI / GENERATIVE MODELS

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Abstract: Generative Artificial Intelligence (Generative AI) is a rapidly growing field that moves beyond traditional data analysis and prediction to the creation of entirely new content. Instead of simply classifying or recognizing existing information, generative models learn patterns, structures, and relationships from large datasets and then use this knowledge to produce original outputs such as realistic images, human-like text, natural-sounding audio, and even dynamic videos. This creative ability has made Generative AI one of the most exciting and transformative areas in modern technology. Different approaches are used to achieve generative capabilities. Generative Adversarial Networks (GANs) work through competition between a generator and a discriminator, producing highly realistic outputs. The impact of Generative AI is already visible in many industries. In art and design, it enables rapid prototyping and creative exploration. In healthcare, it supports the generation of synthetic medical data for research and training. In education, it powers personalized learning materials, while in entertainment, it brings virtual worlds, characters, and music to life. At the same time, these powerful tools raise important concerns.

Keywords: *Generative AI, Generative Adversarial Networks, Variational Autoencoders, Adaptive Learning, Diffusion models, Generative Models.*

HUMAN-COMPUTER INTERACTION (HCI) AND ARTIFICIAL INTELLIGENCE(AI)

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Abstract: Human–Computer Interaction (HCI) and Artificial Intelligence (AI) are two interrelated fields that play a vital role in shaping modern technology. HCI focuses on designing and evaluating interactive systems that are user-friendly, accessible, and efficient, while AI enables machines to simulate human intelligence through learning, reasoning, and adaptation. The integration of AI into HCI has transformed the way humans interact with computers, shifting from traditional input methods such as keyboards and mice to intelligent interfaces like speech, gesture, natural language, and adaptive systems. AI-driven HCI enhances personalization, usability, and decision-making, while HCI principles ensure that AI technologies remain transparent, ethical, and user-centered. Together, HCI and AI contribute to creating smart, intuitive, and human-centric technologies that bridge the gap between human needs and computational capabilities.

Keywords: Artificial Intelligence, Human Computer Interaction, Language models, AI driven HCI, Integrated Technologies.

IMPLEMENTATION OF LANDMINE DETECTION CHIP IN ROBOTICS DOGS

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Abstract: Innovative solutions that combine high detection accuracy with low human risk are necessary to address the ongoing global threat posed by unexploded landmines. To improve autonomous demining operations, this paper investigates the incorporation of a specialized landmine detection chip into quadrupedal robotic platforms, or "robotic dogs." First, we examine existing multi-sensor architectures that combine chemical, metal-detectors, and ground-penetrating radar (GPR) sensors, and we point out their drawbacks in terms of size, power usage, and false-alarm rates. We suggest a novel mixed-signal application-specific integrated circuit (ASIC) that combines AI-accelerated signal processing, nanowire chemical sensing, and quantum magnetometer read-out on a single chip in order to overcome these difficulties. Our results show that robotic demining can be significantly enhanced in terms of efficiency, safety, and scalability with a unified detection ASIC. This strategy opens the door for broad implementation in both military and humanitarian settings by offering a low-power, miniature platform for advanced sensing and on-board AI, which will ultimately speed up landmine removal and save lives.

Keywords: Landmine, Robotic Dogs, ASIC, Quantum Magnetometer, Nanowire Sensing, Autonomous Demining, Sensor Fusion

METaverse, Social & Ethical Implications of AR / VR

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Abstract: The rapid evolution of immersive technologies such as Augmented Reality (AR) and Virtual Reality (VR) has accelerated the development of the Metaverse, a shared virtual environment that blends physical and digital experiences. While these technologies promise transformative applications in education, healthcare, entertainment, and remote collaboration, they also raise significant social and ethical concerns. Issues such as privacy, data security, digital addiction, identity manipulation, and unequal access highlight the potential risks associated with widespread adoption. Furthermore, ethical challenges emerge in regulating virtual economies, preventing harassment in virtual spaces, and ensuring inclusivity. This project critically examines the social benefits of AR/VR such as enhanced learning, global connectivity, and accessibility alongside the ethical challenges posed by their integration into daily life. By analyzing case studies, current frameworks, and future trends, this work seeks to provide insights into how societies can maximize the positive potential of the Metaverse while minimizing its ethical risks. Ultimately, the study emphasizes the need for responsible innovation, ethical governance, and inclusive design principles to ensure that AR/VR technologies serve humanity in a fair, safe, and sustainable manner.

Keywords: Electric Vehicles, Renewable energy, IoT.

Multi-Modal AI Approaches for Early Risk Stratification in COVID-19 Patients

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Abstract: The COVID-19 pandemic exposed critical limitations in healthcare infrastructure, particularly in resource-constrained settings where hospitals face shortages of beds, ventilators, and medical personnel. Timely identification of high-risk patients is crucial for effective intervention and resource allocation. This paper presents an AI-driven framework for early-stage mortality prediction in COVID-19 patients by integrating multi-modal data, including chest X-ray imaging and electronic health records (EHRs). Deep learning architectures, such as Convolutional Neural Networks (CNNs) for image analysis and Long Short-Term Memory (LSTM) networks for temporal EHR data, are employed to extract and fuse relevant features, enabling accurate risk stratification. Challenges for low-resource healthcare facilities, including limited computational capacity and data availability, are addressed, along with potential solutions like cloud-based deployment and lightweight models.

Keywords: COVID-19, Mortality Prediction, Deep Learning, Multi-Modal Data, Convolutional Neural Networks (CNN),

NEUROMORPHIC COMPUTING AND BRAIN INSPIRED AI MODELS

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Abstract: This project proposes the development of neuromorphic computing and brain-inspired AI models that mimic the structure and function of biological brains. The goal is to create adaptive and scalable AI systems that can efficiently process sensory information, recognize patterns, and make decisions in real-time. We will design and implement spiking neural networks to achieve this objective. Neuromorphic computing architectures will be developed to emulate neural networks and synaptic plasticity. The performance of neuromorphic systems will be evaluated in various applications. We expect to develop efficient and adaptive AI systems that can learn and adapt to new environments. The project will also explore implementations of neuromorphic computing. The potential applications of this project include various fields. By leveraging neuromorphic computing, we can create more efficient AI systems.

Keywords: Spiking Neural Networks, Synaptic Plasticity, Neuromorphic Computing.

SECURITY, PRIVACY, SAFETY IN IOT /CYBER-PHYSICAL SYSTEMS

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Abstract: The rapid growth of the Internet of Things (IoT) and Cyber-Physical Systems (CPS) has created smarter homes, cities, industries, and healthcare solutions by connecting digital intelligence with the physical world. These systems promise efficiency, automation, and improved quality of life, yet they also introduce critical challenges in terms of security, privacy, and safety. Security risks arise from the vulnerability of IoT devices and networks to cyberattacks such as malware, denial-of-service, and unauthorized access, which may disrupt services and compromise trust. Privacy concerns emerge due to the continuous collection of sensitive personal data like health records, location information, and user habits, raising questions about consent, data misuse, and identity protection. Safety becomes even more pressing in environments like healthcare monitoring systems, autonomous vehicles, and smart grids, where system failures or malicious attacks can lead to physical harm, accidents, or even loss of life. To address these issues, researchers and industries are developing lightweight cryptographic methods, secure communication protocols, privacy-preserving frameworks, real-time monitoring systems, and fail-safe designs..

Keywords: Internet Of Things, Cyber Physical systems, Cryptography.

SOUND RECOGNITION USING ARTIFICIAL INTELLIGENCE (AI)

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Abstract: Sound recognition using Artificial Intelligence (AI) has emerged as a powerful technology enabling machines to interpret and classify auditory signals with high accuracy. Unlike Traditional methods of audio analysis, AI leverages machine learning and deep learning techniques to process complex sound patterns, including speech, environmental sounds, Music, and abnormal acoustic events. By extracting features such as frequency, pitch, and temporal patterns, AI models can identify, categorize, and even Applications of AI-based sound recognition span across diverse domains, including healthcare (detecting abnormal heartbeats or respiratory sounds), security (gunshot or glass-break detection), smart homes (voice- activated assistants), and industrial monitoring (machine fault detection). The growing integration of AI with Internet of Things (IoT) devices has further enhanced real-world deployment, making systems more responsive and adaptive. Despite its rapid progress, challenges such as background noise.

Keywords: Artificial Intelligence, Sound Recognition, Machine Learning, Deep Learning, IoT , Audio Classification, Smart Systems.

TURNING AGRICULTURAL WASTE INTO WEALTH - A SUSTAINABLE APPROACH USING DECISION TREE ALGORITHM

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Abstract: Agriculture generates a large volume of residues, such as crop stalks, husks, peels, and animal manure, much of which is underutilized and often disposed of in ways that harm the environment. Transforming this waste into useful resources such as compost, biofertilizers, animal feed, renewable energy, and biodegradable products offers both economic and ecological benefits. This paper explores a sustainable “waste-to-wealth” approach by applying the Decision Tree algorithm to classify agricultural residues based on their properties and potential applications. The model assists in determining whether a particular type of waste is best suited for composting, energy generation, recycling, or feed production. By integrating simple machine learning techniques with agricultural practices, the proposed framework promotes resource efficiency, reduces pollution, and supports a circular economy in farming. The findings emphasize that combining digital technologies with traditional agriculture can accelerate the adoption of eco-friendly solutions and empower rural communities with additional income opportunities.

Keywords: Agricultural Waste, Waste-to-Wealth, Decision Tree, Machine Learning, Circular Economy, Resource Recovery, Sustainable Agriculture.

AI TOOLS FOR SENTIMENT ANALYSIS

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Abstract: Sentiment analysis, also known as opinion mining, has become a critical application of artificial intelligence (AI) in understanding human emotions and attitudes expressed through text, speech, and multimedia data. Leveraging natural language processing (NLP), machine learning, and deep learning techniques, AI-powered sentiment analysis tools can automatically classify opinions as positive, negative, or neutral, and even detect nuanced emotions such as joy, anger, or sarcasm. These tools are increasingly employed across diverse domains, including customer feedback evaluation, social media monitoring, market research, and decision support systems. Recent advancements in transformer-based models, such as BERT and GPT, have significantly improved accuracy by capturing contextual meaning and sentiment subtleties. Despite their promise, challenges remain in handling domain-specific language, multilingual data, and cultural variations in sentiment expression. This paper explores the evolution, methodologies, and applications of AI-driven sentiment analysis tools, while highlighting current limitations and future opportunities for more adaptive, interpretable, and ethical sentiment analysis systems.

Keywords: Sentiment Analysis, Opinion Mining, Natural Language Processing, Deep Learning, Machine Learning, Emotion Detection.

HUMAN-AI COLLABORATION: SHAPING THE FUTURE OF WORK

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Abstract: The rapid advancement of Artificial Intelligence (AI) is transforming the nature of work across industries, creating both opportunities and challenges. Rather than replacing human capabilities, AI is increasingly being integrated as a collaborative partner, augmenting decision-making, enhancing productivity, and fostering innovation. This paper explores the evolving paradigm of human-AI collaboration, emphasizing its role in reshaping organizational structures, skill requirements, and workplace dynamics. Key areas of focus include the balance between automation and human creativity, ethical considerations in deploying AI systems, and the importance of trust, transparency, and accountability. By analyzing case studies and emerging trends, the paper highlights how effective collaboration between humans and AI can lead to sustainable growth, inclusive development, and a redefined workforce ecosystem. The findings suggest that future workplaces will thrive on synergistic interactions where AI handles repetitive, data-driven tasks while humans focus on strategic, empathetic, and creative functions.

Keywords: Artificial Intelligence, Human-AI Collaboration, Future of Work, Automation, Ethical AI

ROBUSTNESS, FAIRNESS, BIAS & ETHICS IN AI/ML

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Abstract: Robustness in AI/ML refers to a model's ability to maintain its performance and accuracy when faced with unexpected or novel inputs that differ from its training data. This includes resistance to noise, slight perturbations, and adversarial attacks. A lack of robustness can lead to system failures and security vulnerabilities, as seen when a vehicle's emissions detection system fails to function correctly in different environments or with different vehicle types. The project detailed in the provided document aims to address these issues by creating a system that is applicable to all vehicles. Fairness and Bias are closely related concepts. Bias is the root cause of unfairness in AI/ML systems. It goes beyond the technical aspects of fairness and bias to address questions of accountability, transparency, and societal impact. For instance, the described system aims to reduce vehicle emissions and improve air quality for a healthy living environment. However, an ethical framework would also consider who is responsible if the system malfunctions, or if the "shutting off" feature causes a hazardous situation..

Keywords: Artificial Intelligence, Machine Learning, Ethical AI, Environment Sustainability.

TRANSFER LEARNING, ENSEMBLE LEARNING, DISTRIBUTED & DECENTRALIZED ML

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Abstract: In recent years, the advancement of machine learning (ML) has been accelerated by approaches that enhance model efficiency, scalability, and adaptability. Transfer Learning enables models to leverage prior knowledge from related tasks or domains, reducing training time and improving performance, especially when data is scarce. Ensemble Learning combines multiple models to achieve higher accuracy, robustness, and generalization than individual learners, making it a powerful strategy for reducing bias and variance. At the same time, the growing scale of data and computational needs has driven the rise of Distributed Machine Learning, where training is parallelized across multiple nodes to handle large datasets efficiently. Complementing this, Decentralized Machine Learning approaches, such as federated learning, focus on privacy-preserving collaboration by training models locally on edge devices without sharing raw data, thereby addressing data governance and security challenges. Together, these paradigms represent the next generation of ML techniques, enabling more scalable, accurate, adaptive, and privacy-preserving systems applicable across healthcare, finance, IoT, and other data-intensive domains.

Keywords: Artificial Intelligence, Machine Learning, Internet of Things, Distributed Systems.

WIRELESS COMMUNICATION

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Abstract: The Future of Mobile Transport Looks Exhilarating with the Potential New Use cases and Questioning Necessities Of Future 6th Creation (6G) and Further Wi-Fi networks. The Recent Arrival of Reconfigurable Smart Surfaces in Wi-Fi Telecommunications Authorizes, on the other hand, network drivers to control the Uneven, Thinking , and refraction traits of the Transmission Waves, by overcoming the Negative belongings of Instinctive Wi-Fi diffusion. The Fundamental Difference Accompanying Different Electronics, Ultimate main open Research issues to tackle , and the reasons why the use of reconfigurable brilliant surface makes necessary to Reconsider the ideas theoretical models working in Wi-Fi networks. Creative surface-helped ideas systems utilizing analytical methods and expands on the potential use cases of bright surfaces in 6G and beyond Wi-Fi networks.

Keywords: Wi-Fi Telecommunications, 6th Creation (6G), Future of Mobile Transport.

THE FUTURE OF AUTONOMOUS VEHICLES AND INTELLIGENT ROBOTICS

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Abstract: The future of transportation and industry is being revolutionized by autonomous vehicles and intelligent robotics. Autonomous vehicles use sensors, AI, and machine learning to navigate roads safely and efficiently. Intelligent robotics enables machines to perform complex tasks with precision and accuracy. These technologies have the potential to transform industries and improve daily life. Autonomous vehicles can reduce accidents, improve traffic flow, and enhance mobility for the elderly and disabled. Intelligent robots can work alongside humans, enhancing productivity and efficiency. The integration of autonomous vehicles and intelligent robotics will have a significant impact on the economy and society. However, regulatory frameworks, safety, and security are crucial challenges to be addressed. Public acceptance and trust in these technologies are also essential for widespread adoption. Despite challenges, the benefits of autonomous vehicles and intelligent robotics make them an exciting area of research and development. Future advancements will focus on improving AI, sensor technology, and machine learning. As these technologies evolve, we can expect significant improvements in transportation, industry, and daily life. The future of autonomous vehicles and intelligent robotics is rapidly evolving. Staying informed about the latest developments is crucial. By understanding the potential benefits and challenges, we can work towards a safer, more efficient future.

Keywords: Autonomous Vehicles, Intelligent Robotics, Artificial Intelligence ,Machine Learning ,Robotics Automation

ENERGY-EFFICIENT IOT NETWORKS FOR SMART CITIES

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Abstract : Smart cities rely heavily on IoT devices to monitor and manage resources efficiently. However, the limited battery life of IoT sensors poses a significant challenge to sustainable deployment. This project proposes an energy-efficient IoT network architecture optimized for smart city applications such as smart lighting and environmental monitoring. By combining energy-saving communication protocols, edge data processing, and optimized network topology, the proposed system significantly extends sensor lifetime while maintaining reliable data transmission. Simulations demonstrate up to 40% energy savings compared to traditional approaches, highlighting its potential for scalable smart city deployments. Energy efficiency is therefore critical to prolong device lifetime, reduce operational costs, and ensure sustainable smart city solutions. Energy Consumption in IoT: Analysis of power usage in sensing, communication, and data processing. Energy-saving Protocols: MQTT, CoAP, and IEEE 802.15.4 standards and their pros and cons. Edge Computing: How local processing reduces network load and saves energy. Energy Harvesting: Brief look at solar and kinetic energy for autonomous sensors.

Keywords : Smart City, Internet of Things (IoT), Energy Efficiency, Edge Computing, MQTT, Network Topology, Wireless Sensor Networks, Duty Cycling, LoRaWAN, ZigBee.

EXPLAINABLE AI: MAKING BLACK BOX MODELS TRANSPARENT

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Abstract: Artificial Intelligence (AI) has become one of the most transformative technologies of the 21st century, with applications spanning healthcare, finance, education, manufacturing, autonomous vehicles, and cybersecurity. The growing adoption of AI, particularly advanced deep learning and ensemble-based architectures, has led to impressive accuracy and predictive performance in solving highly complex problems. However, these models are often regarded as "black boxes" because their internal decision-making processes remain hidden and difficult to interpret. This lack of transparency introduces several challenges related to trust, accountability, fairness, ethical responsibility, and regulatory compliance, especially in safety-critical and socially sensitive domains. Explainable AI (XAI) has emerged as a rapidly growing and interdisciplinary research area that aims to make AI models more transparent, interpretable, and trustworthy.

Keywords: Artificial Intelligence, Black Box Models, Explainable AI (XAI), Transparency, Interpretability, Accountability, Ethical AI, Trustworthy AI, Responsible Innovation

NOVEL IOT COMMUNICATION PROTOCOLS TECHNOLOGIES (5G+, 6G, backscatter, etc)

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Abstract: The IoT devices placed in remote locations require a battery replacement very often, which is not a convenient option. Backscatter communication can resolve this problem, as backscatter communication is a data transmission in which an RF signal incident from the gateway is used for energy harvesting, and this energy will be employed for data transmission. In this paper, a hybrid contention-based TDMA scheme is proposed, which provides slots to devices by dividing them into groups, and then contention is employed in groups to acquire a slot; if a device is not able to transmit during harvest, then transmit (HTT) period, then it can transmit in variable sub frame and the devices which are not able to completely transmit during HTT period can reserve subframes. The proposed hybrid scheme is compared with the TDMA scheme for average transmission delay. The proposed scheme provides scalability.

Keywords: Artificial Intelligence (AI), Machine Learning (ML), Deep Learning.

FROM WORDS TO WONDERS: GENERATIVE AI IN IMAGES AND MUSIC

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Abstract: In the rapidly evolving landscape of artificial intelligence, Generative AI stands as a groundbreaking innovation redefining the boundaries of human creativity. Unlike traditional AI systems that analyze or predict existing data, Generative AI has the remarkable ability to create entirely new and original content—transforming imagination into vivid digital realities. By converting abstract concepts into expressive visuals and harmonious compositions, it bridges the gap between human thought and technological expression. This project, “*From Words to Wonders: Generative AI in Images and Music*,” explores the dynamic capabilities of AI-driven creativity through interactive demonstrations. The system utilizes advanced text-to-image and text-to-music models, allowing users to generate stunning visuals and original melodies from simple textual prompts. These tools exemplify how AI can act as a creative collaborator, amplifying human innovation and enabling limitless artistic exploration. Beyond its artistic impact, Generative AI is revolutionizing diverse fields such as education, design, media, and entertainment.

Keywords: Artificial Intelligence, Generative AI, Text-to-Image, Text-to-Music, AI Art, AI Music, Creative AI Innovation, Machine Learning, AI-Driven Art, Future of Creativity, AI in Media and Entertainment.

FROM DIAGNOSIS TO DISCOVERY: ADVANCED AI APPLICATIONS IN MODERN HEALTHCARE

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Abstract: Healthcare is entering a transformative era where Artificial Intelligence (AI) has evolved from a supporting tool to an active collaborator in saving lives. Once a futuristic concept, AI now forms the backbone of modern medical innovation, integrating intelligent systems across every layer of healthcare delivery. From algorithms capable of detecting cancer at its earliest stages to predictive models that forecast patient deterioration, AI is revolutionizing diagnosis, treatment, and patient care. In biomedical research and drug discovery, AI-driven computational models drastically reduce the time required to identify new therapeutic compounds, accelerating the development of life-saving medicines. Robotic surgical systems equipped with AI enhance precision, minimize human error, and enable minimally invasive procedures. Furthermore, natural language processing (NLP) transforms vast amounts of unstructured medical data into actionable insights, while virtual health assistants ensure continuous patient engagement and accessibility.

Keywords: Artificial Intelligence (AI), Machine Learning (ML), Deep Learning, Predictive Analytics, Diagnostic Imaging, Natural Language Processing (NLP), Precision Medicine, Robotic Surgery

GENERATIVE AI AND LARGE LANGUAGE MODELS ADVANCES, CHALLENGES AND RESPONSIBLE DEPLOYMENT

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Abstract: Generative Artificial Intelligence (AI) and Large Language Models (LLMs) are driving a new wave of innovation, enabling machines to produce human-like text, images, and solutions across diverse domains such as healthcare, education, and business. Their rapid progress demonstrates remarkable advances in natural language understanding, creativity, and problem-solving. Establishing strong evaluation methods, bias mitigation strategies, and regulatory frameworks is essential for building trust and ensuring safe adoption. By striking a balance between innovation and responsibility, generative AI and LLMs can deliver sustainable benefits while safeguarding societal values and ethical principles.

Keywords: Generative AI, Large Language Models, Responsible AI, Bias Mitigation, Transparency, Accountability, Ethical AI, Fairness, Governance, Trustworthy AI.

GENERATIVE AI FOR DYNAMIC STORYTELLING IN GAMES

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Abstract: Generative Artificial Intelligence (AI) is revolutionizing the gaming industry by enabling dynamic storytelling that adapts in real-time to player decisions, actions, and preferences. Traditional game design often relies on pre-scripted storylines and limited player agency, resulting in repetitive and predictable experiences. Generative AI, however, empowers developers to create immersive and personalized narratives that evolve organically. This paper explores the application of generative AI in dynamic storytelling within games, focusing on techniques such as procedural content generation, natural language processing, and machine learning. By leveraging generative AI, game developers can craft experiences that are not only engaging but also unique to each player, pushing the boundaries of interactive entertainment.

Keywords: Generative AI, Dynamic Storytelling, NPCs, Procedural Content Generation, Interactive Narratives.

GREEN AI : BUILDING ENERGY-ENERGY EFFICIENT AND SUSTAINABLE MACHINE LEARNING MODELS

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Abstract: The increasing adoption of machine learning (ML) in building energy management presents a promising avenue for enhancing energy efficiency and sustainability. However, the computational demands of traditional ML models contribute to significant energy consumption, undermining the environmental benefits they aim to achieve. By integrating these approaches, building energy management can achieve a balance between operational energy savings and the environmental costs of computation, ultimately contributing to more sustainable smart building solutions.

Keywords: Green AI, Building energy management, Energy-efficient machine learning, Sustainable AI, Lightweight model, Edge computing, Transfer learning, Energy-aware training, Smart buildings, Environmental sustainability

HANDLING EXPONENTIAL IOT DATA: STREAMING AND ANALYTICS

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Abstract: Data generated by the Internet of Things (IoT) is growing at an exponential rate, posing significant challenges for traditional data processing systems. This abstract presents a comprehensive framework for handling this massive influx of data, focusing on real-time streaming and advanced analytics. Every single smart device—from your watch to your car to a lightbulb—is constantly shouting out data. The amount of information is huge, and it's all happening incredibly fast. Essentially, we're taking a massive flood of data and turning it into smart decisions, helping people and businesses work better, faster.

Keywords: Bio-Fertilizer, Panchgavya, Organic Farming, Automated Stirring, Mechanized Solution

HUMAN-AI COLLABORATION: DESIGNING TRUSTWORTHY AND INTERACTIVE INTELLIGENT SYSTEMS

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Abstract: The growing integration of Artificial Intelligence (AI) into human-centered activities is reshaping the way individuals interact, work, and make decisions. While AI systems offer powerful capabilities, their effectiveness depends on establishing trust, transparency, and seamless collaboration with human users. Traditional AI models often lack explainability and adaptability, leading to skepticism and limited adoption. To address this, Human-AI collaboration has emerged as a critical research domain, focusing on designing interactive systems that are both reliable and socially responsible. This involves incorporating explainable AI (XAI), ethical frameworks, adaptive interfaces, and user centered design principles to ensure systems align with human values and decision-making processes. Real-world applications across healthcare, education, industry, and governance demonstrate the potential of such systems in enhancing productivity, creativity, and problem-solving. However, challenges remain in mitigating bias, ensuring accountability, and balancing automation with human oversight. This paper explores the evolution of Human-AI collaboration, its applications, benefits, and limitations, while emphasizing the importance of building trustworthy and interactive intelligent systems for a sustainable digital future.

Keywords: Human-AI Collaboration, Trustworthy AI, Explainable AI, Ethical Design, Interactive Systems, User-Centered Design

HUMAN-COMPUTER INTERACTION, VISION, AND PERCEPTION IN ML SYSTEMS

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Abstract: The convergence of Human-Computer Interaction (HCI), computer vision, and perceptual modelling, within Machine Learning (ML) systems marks a transformative shift in how intelligent technologies interface with human users and interpret the world. As ML systems become deeply embedded in everyday applications—from autonomous vehicles and healthcare diagnostics to intelligent virtual assistants and augmented reality—understanding and designing for human perception and interaction paradigms becomes increasingly critical. This multidisciplinary intersection aims to create systems that not only perceive their environment through vision and sensor data but also interact with humans in ways that are intuitive, adaptive, and contextually aware. Central to this evolution is the integration of computer vision technologies, enabling machines to interpret and act upon visual information with increasing accuracy and nuance

Keywords: Human-AI Collaboration, Trustworthy AI.

HYBRID INTELLIGENCE: COMBINING HUMAN EXPERTISE WITH ARTIFICIAL INTELLIGENCE

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Abstract: The rapid advancement of Artificial Intelligence (AI) has transformed decision-making, problem-solving, and automation across multiple domains. However, despite its computational power, AI often lacks contextual awareness, ethical reasoning, and domain-specific intuition that humans possess. Conversely, human expertise, though rich in experience and judgment, is limited by cognitive biases and processing capacity. Hybrid Intelligence (HI) emerges as a paradigm that integrates the strengths of human cognition with AI's analytical and computational capabilities, fostering a symbiotic relationship that enhances performance beyond the limits of either entity alone. Furthermore, it addresses challenges such as trust, interpretability, collaboration dynamics, and ethical considerations in human-AI teaming. By demonstrating how human knowledge and AI systems can complement each other, this study highlights Hybrid Intelligence as a promising pathway toward responsible, efficient, and context-aware intelligent systems.

Keywords: Hybrid Intelligence, Human-AI Collaboration, Human-in-the-Loop, Cognitive Augmentation, Decision Support Systems, Explainable AI, Distributed Intelligence, Human Expertise Integration, Artificial Intelligence Applications, Ethical AI

IMPACT OF AI ON SOCIETY TRANSFORMING SOCIETY THROUGH AUTOMATIONS, ETHICS AND INNOVATIONS

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Abstract: Artificial Intelligence (AI) is transforming the fabric of modern society, driving advancements across industries while raising critical ethical, social, and economic questions. From healthcare and education to transportation and finance, AI enhances efficiency, decision-making, and innovation. It enables predictive analytics, personalized services, and automation of complex tasks, contributing to improved quality of life and global connectivity. However, AI also poses significant challenges, including job displacement, algorithmic bias, privacy concerns, and the potential for misuse in surveillance or autonomous weapons. The societal impact of AI thus demands a balanced approach—leveraging its benefits while establishing robust governance, transparency, and ethical standards. This paper explores the multifaceted influence of AI, emphasizing the need for inclusive policies and interdisciplinary collaboration to ensure that AI development aligns with human values and promotes equitable progress.

Keywords: Artificial intelligence, Innovations, Algorithmic bias

IMPACT OF AI ON SOCIETY

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Abstract: Artificial Intelligence (AI) has emerged as a transformative force reshaping modern society across multiple domains, including healthcare, education, business, governance, and everyday life. Its capabilities in automation, data-driven decision-making, and human-machine collaboration have introduced unprecedented opportunities for efficiency, innovation, and economic growth. However, the widespread adoption of AI also raises critical challenges such as ethical concerns, bias in algorithms, job displacement, data privacy risks, and the need for robust regulatory frameworks. This paper explores both the positive contributions and the potential drawbacks of AI in shaping social structures, labor markets, and human interactions. By analyzing case studies, technological advancements, and societal responses, the study highlights the dual role of AI as both an enabler of progress and a driver of disruption.

Keywords : Artificial Intelligence (AI), Automation, Ethical AI, Social Impact, Data Privacy, Human-AI Collaboration, Algorithmic Bias, Digital Transformation, Responsible AI, Future of Work.

IMPACT OF AI ON SOCIETY

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Abstract: Artificial Intelligence (AI) is rapidly transforming modern society by reshaping industries, economies, and everyday life. Its applications range from healthcare, education, and transportation to communication, entertainment, and governance. AI has the potential to increase efficiency, enhance decision-making, and create new opportunities for innovation and economic growth. However, its widespread adoption also raises critical concerns, including ethical challenges, job displacement, data privacy, and bias in decision-making. The societal impact of AI is therefore a complex interplay of opportunities and risks that requires balanced approaches in policy, regulation, and public awareness. Understanding these dynamics is essential for ensuring that AI contributes to human well-being while minimizing potential harms.

Keywords: Automation, Employment, Ethics, Privacy, Economy, Human Well-being, Artificial Intelligence

COMPUTING POWER CHALLENGES: ENERGY, EFFICIENCY, AND SCALABILITY

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Abstract: The rapid evolution of computing technologies, driven by the proliferation of artificial intelligence, big data, edge computing, and cloud infrastructure, has led to unprecedented demands for computational power. While this advancement enables significant break throughs in science, healthcare, finance, and beyond, it also introduce critical challenges related to energy consumption, system efficiency, and scalability. This paper explores the multifaceted nature of these challenges, analyzing the trade-offs and constraints that define modern computational architecture. Efficiency, both in hardware and software, is equally crucial. Improvements in chip design, such as heterogeneous computing, GPU acceleration, and specialized ASICs, have pushed the limits of performance-per-watt. However, inefficiencies in software algorithms, memory management, and task scheduling continue to hinder optimal resource utilization. The increasing complexity of systems also introduces latency, bottlenecks, and overhead that reduce overall throughput. Scalability presents another dimension of complexity

Keywords: Computational Power, Energy Efficiency, Scalability, High-Performance Computing (HPC) DataCenters, Green Computing, Sustainable Computing, Performance-per-Watt, Hardware Acceleration

COST-EFFECTIVE AI AND IOT BASED SMART SYSTEM FOR PRECISION WATER MANAGEMENT IN AGRICULTURE

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Abstract: Water scarcity and inefficient irrigation remain major challenges in agriculture. This paper presents a cost-effective smart system using Artificial Intelligence (AI) and Internet of Things (IoT) for precision water management. Real-time data from soil moisture sensors, weather forecasts, and crop type are used to optimize irrigation schedules through AI algorithms. IoT devices ensure automated control and remote monitoring, reducing water waste and improving crop yield. The system includes a mobile app for real-time access and alerts, and uses solar-powered sensors for energy efficiency. Field tests show improved water usage, reduced costs, and increased productivity. Scalable and farmer-friendly, this solution supports sustainable agriculture and contributes to long-term water security. Here's an enhanced version of your abstract with additional points, covering energy efficiency, user interface, data analytics, and future scalability. Water scarcity and inefficient irrigation practices pose major challenges in modern agriculture.

Keywords: Energy Efficiency, Crop Yield Improvement, Remote Monitoring, Digital Farming.

DATA-CENTRIC AI: RETHINKING THE ROLE OF DATA IN MACHINE LEARNING SYSTEMS

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Abstract: The rapid advancements in Artificial Intelligence (AI) have predominantly focused on model-centric approaches, where optimizing complex algorithms and architectures takes precedence. However, a paradigm shift towards Data-Centric AI recognizes the profound impact of data quality, quantity, and preparation on the performance and reliability of machine learning systems. This paper explores the concept of Data-Centric AI, emphasizing its critical role in enhancing model robustness, fairness, and generalization. We delve into various aspects of data management, including data collection, labeling, augmentation, and cleaning, and discuss their implications for real-world AI applications. Furthermore, we highlight the challenges associated with implementing data-centric strategies, such as managing data at scale, ensuring data privacy, and mitigating biases inherent in datasets. By rethinking the traditional model-centric view and prioritizing data excellence, Data-Centric AI promises a more sustainable and impactful future for machine learning, leading to more accurate, equitable, and trustworthy AI systems.

Keywords: Data-Centric AI, Machine Learning, Data Quality, Data Preparation, Model Robustness, Fairness, Generalization, Data Management, Data Bias, AI Systems.

DEEP LEARNING-DRIVEN DISEASE DETECTION AND GROWTH MONITORING IN TOMATO PLANTS FOR SMART AGRICULTURE

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Abstract: Tomato plants are highly susceptible to diseases and environmental stress, leading to significant yield losses and reduced quality. This paper proposes a deep learning-based framework for automated disease detection and growth monitoring in tomato cultivation. The system leverages convolutional neural networks (CNNs) to classify leaf images into multiple disease categories, including early blight, late blight, and leaf mold, with high accuracy. Furthermore, a growth stage prediction model is integrated to assess plant health and phenological development in real time. The framework is validated on publicly available tomato plant datasets, achieving an overall classification accuracy of 96.8% for disease detection and 94.5% for growth stage recognition..

Keywords: Tomato plant, Deep learning, Convolutional neural networks (CNN), Disease detection, Precision agriculture.

EARLY CROP DISEASE DETECTION

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Abstract: Early and accurate detection of crop diseases is essential for sustainable agriculture and global food security, especially in regions with limited computational and data resources. While deep neural networks (DNNs) achieve near-perfect accuracy on datasets like PlantVillage, real-world deployment remains challenging due to their heavy data and computational demands. This paper proposes a unified and deployable framework that integrates three components: (i) Coreset Selection (random, margin-based, and forgetting-based) to construct compact training subsets using as little as 5% of the original data, (ii) Resolution Scaling with downsampled image resolutions (128×128, 64×64, 32×32) to lower computational costs. Results further highlight that forgetting-based and margin-based coreset selection outperform random selection under limited data scenarios, and that resolution scaling at 64×64 offers a practical balance between performance and efficiency. Moreover, adaptive compression methods such as Layer-wise Adaptive Quantization (LAQ) and Layer-wise Adaptive Pruning (LAP) outperform uniform compression, preserving accuracy while significantly improving compactness.

Keywords: Crop disease detection, Sustainable agriculture, Low-resource settings, Deep neural networks (DNNs).

EARLY DISEASE PREDICTION USING AI

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Abstract: The rapid growth of Artificial Intelligence (AI) in healthcare has enabled the development of intelligent systems for early disease prediction, aiming to improve patient outcomes through timely diagnosis and preventive care. This project focuses on utilizing machine learning models to predict the likelihood of diseases such as diabetes, heart disease, and cancer by analyzing clinical data, patient history, and lifestyle patterns. The system applies advanced data preprocessing, feature selection, and machine learning algorithms including Logistic Regression, Random Forest, and Gradient Boosting to identify hidden patterns and risk factors in large datasets. Visualization and exploratory data analysis (EDA) techniques are integrated to make the results interpretable for healthcare professionals. Evaluation metrics such as accuracy, precision, recall, and F1-score are used to validate model efficiency. By providing personalized risk assessments and supporting doctors with AI-driven insights, this project demonstrates how data science can transform healthcare from a reactive to a proactive system, ensuring early intervention and better patient management.

Keywords :Artificial Intelligence (AI), Early disease prediction, Machine learning models, Clinical data analysis, Logistic Regression, Exploratory Data Analysis (EDA), Evaluation metrics (accuracy, precision, recall, F1-score).

EDGE AI AND INTELLIGENT EDGE / COMPUTING CONTINUUM

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Abstract :Edge AI and Intelligent Edge are transforming the digital ecosystem by enabling real-time data processing closer to the source, reducing latency, and enhancing efficiency in the computing continuum. Unlike traditional cloud-based processing, Edge AI distributes intelligence across IoT devices, gateways, and local servers, thereby ensuring rapid decision-making, privacy preservation, and optimized bandwidth usage. This approach is particularly impactful in applications like smart cities, healthcare, autonomous vehicles, and industrial automation, where milliseconds matter. The computing continuum, combining cloud, edge, and IoT infrastructures, creates a seamless flow of data and intelligence across devices, enabling a more scalable, reliable, and intelligent digital environment

Keywords: Bio-Fertilizer, Panchgavya, Organic Farming, Automated Stirring, Mechanized Solution.

EDGE AI INTELLIGENT COMPUTING AT THE DEVICE LEVEL

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Abstract: EdgeAI represents a transformative shift in computing paradigms by bringing artificial intelligence directly to the edge of networks—on devices such as smart phones, sensors, IoT modules, and autonomous machines. Unlike traditional cloud-based models, Edge AI processes data locally, enabling real-time decision-making, reducing latency, preserving bandwidth, and enhancing user privacy. Security and data integrity also pose critical concerns when processing sensitive information locally. This paper explores the current state and future directions of Edge AI, highlighting cutting-edge hardware platforms, software frameworks, and deployment strategies. Emphasis is place do optimizing inference performance, minimizing energy consumption ,and enabling seamless updates and scalability. By pushing AI closer to data sources, Edge AI redefines intelligent systems with a more responsive, secure, and autonomous approach to computing.

Keywords: Edge AI,Edge Computing,On-Device Intelligence,Real-Time Processing,Model Optimization,Federated Learning,Low-Power AI,Neural Network Compression,Intelligent IoT.

EDGE INTELLIGENCE: OPTIMIZING MACHINE LEARNING MODELS FOR LOW – RESOURCE ENVIRONMENT

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Abstract: In the era of pervasive computing, deploying machine learning models in low-resource environments—such as edge devices with limited memory, processing power, and energy—poses significant challenges. This paper explores the paradigm of Edge Intelligence, focusing on strategies to optimize machine learning models for efficient inference and adaptability in constrained settings. Techniques such as model compression, quantization, pruning, and knowledge distillation are examined for their effectiveness in reducing computational overhead while maintaining accuracy. Additionally, we investigate lightweight architectures and federated learning approaches that enable decentralized intelligence without compromising data privacy. Through case studies and performance benchmarks, we demonstrate how these optimizations empower real-time decision-making in applications ranging from remote healthcare to smart agriculture. The findings underscore the transformative potential of Edge Intelligence in democratizing AI access and fostering sustainable, scalable solutions for resource-constrained environments.

Keywords: Edge Intelligence, Low-resource environments, Model optimization, Machine learning, Model compression, Quantization, Pruning.

EDUTRUST AI: VERIFYING STUDENT SKILLS BEYOND MARKSHEETS

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Abstract: In the evolving landscape of education and employment, traditional academic credentials such as marksheets and certificates are no longer sufficient indicators of a student’s true capabilities. The increasing prevalence of fraudulent documents and the lack of standardized skill validation mechanisms have created a pressing need for a more reliable and transparent system. This paper introduces EduTrust AI, a comprehensive, multi-layered framework designed to verify student skills beyond conventional academic records. As industries increasingly prioritize practical abilities over traditional qualifications, it becomes essential to have a framework that can objectively validate student competencies. EduTrust AI not only addresses this gap but also sets a new standard for credential transparency and verification in the digital age.

Keywords: EduTrust AI, skill-based education, academic credential verification, fake certificate detection, skill graph mapping, AI-based assessments, blockchain credential storage, credential transparency, educational fraud prevention.

INTERPRETABLE AND SCALABLE MACHINE LEARNING FRAMEWORK FOR DERMATOLOGICAL INJURY CLASSIFICATION

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Abstract: This study explores the integration of machine learning (ML) in dermatology to achieve rapid and reproducible classification of skin injuries, reducing the subjectivity of visual diagnosis. While deep learning (DL) models such as CNNs and ViTs show strong accuracy, this work emphasizes interpretable and computationally efficient ML approaches, including support vector machines, random forests, and gradient boosting with handcrafted features (color, texture, and shape descriptors). The study evaluates cross-dataset generalization, model calibration, and fairness across diverse skin tones, using metrics such as AUC-ROC and Cohen’s kappa. Explainable AI (XAI) techniques such as SHAP, LIME, and saliency mapping are applied to improve clinical trust. Future directions include transfer learning, multimodal fusion of dermoscopic images and patient records, and continual learning systems for real-world adaptability. Edge AI and federated learning are highlighted for privacy-preserving, low-latency deployment in teledermatology and mobile diagnostics.

Keywords: Machine Learning, Explainable AI, CNN models, Dermatological Injury, Image Classification, Edge AI, SHAP, LIME, Federated learning.

ETHICAL IMPLICATIONS OF GENERATIVE AI: DEEPPAKES, ART, AND INTELLECTUAL PROPERTY

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Abstract: Generative Artificial Intelligence (AI) is transforming the way digital content is produced, offering new possibilities in creativity, communication, and innovation while also raising critical ethical challenges. Deepfakes highlight the dangers of misinformation, impersonation, and privacy violations, threatening both individual security and public trust. In the arts, AI blurs the line between human originality and machine generation, prompting debates about authenticity, cultural value, and the potential displacement of creative professionals. Intellectual property concerns further complicate this landscape, as AI models often rely on copyrighted material without consent, creating disputes over authorship, ownership, and fair use. Addressing these issues requires transparent practices, responsible regulation, and updated legal frameworks that balance the benefits of technological progress with the protection of human rights, creativity, and ethical responsibility.

Keywords: *Generative Artificial Intelligence, Deepfakes, Ethical Implications,*

IOT-ENABLED PREDICTIVE MAINTENANCE FOR AUTOMOBILES: PREVENTING BREAKDOWNS WITH DATA

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Abstract: Modern automobiles are increasingly complex, making maintenance more challenging, costly, and critical for safety and reliability. Traditional maintenance strategies, which follow fixed schedules or reactive repairs after failures, often lead to unexpected breakdowns, higher expenses, and reduced component lifespan. This project proposes an IoT-enabled predictive maintenance system that utilizes real-time sensor data and onboard diagnostics to detect potential issues before they become severe. The system continuously monitors vital parameters such as engine temperature, vibrations, oil quality, tire pressure, and battery health. Data is transmitted via 4G, 5G, or Wi-Fi to a cloud platform where machine learning algorithms and analytics identify patterns indicating potential failures. Alerts are promptly sent to drivers and manufacturers via mobile or in- car applications to enable timely maintenance interventions.

Keywords: *IoT, Predictive Maintenance, Vehicle Safety, Sensors, Machine Learning, Fleet Management, Data Analytics.*

IMPACT OF AI ON SOCIETY

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Abstract: Artificial Intelligence (AI) is reshaping the fabric of modern society, influencing sectors ranging from healthcare and education to transportation, finance, and governance. This paper explores the multifaceted impact of AI, highlighting both its transformative potential and the ethical, economic, and social challenges it presents. By automating tasks, enhancing decision-making, and enabling predictive analytics, AI contributes to increased efficiency and innovation. However, concerns around job displacement, data privacy, algorithmic bias, and accountability demand critical attention. The paper also examines the evolving relationship between humans and intelligent systems, emphasizing the need for inclusive policies and responsible AI development to ensure equitable benefits across society.

Keywords: Artificial Intelligence, Social Impact, Automation, Ethics in AI, AI Governance Machine Learning, Data Privacy, Algorithmic Bias, Human-AI Interaction, Technological Disruption.

MACHINE LEARNING FOR SUSTAINABLE DEVELOPMENT AND GREEN COMPUTING

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Abstract: The rapid growth of digital technologies has significantly increased energy consumption and carbon emissions, raising urgent concerns for sustainability. Machine Learning (ML) offers powerful solutions to address these challenges by enabling intelligent resource management, optimizing energy usage, and minimizing environmental impacts. This paper explores the role of ML in fostering sustainable development and advancing green computing practices. Key areas of application include smart energy systems, efficient data center operations, predictive maintenance, and sustainable urban planning. By leveraging algorithms for demand forecasting, workload optimization, and carbon footprint reduction, ML-driven approaches support the transition toward eco-friendly computing infrastructures. Furthermore, the integration of ML with renewable energy and circular economy models presents opportunities for achieving the United Nations Sustainable Development Goals (SDGs). The study emphasizes the dual role of ML as both a technological enabler and a catalyst for environmental responsibility, highlighting its potential to build resilient, energy-efficient, and sustainable digital ecosystems.

Keywords: Machine Learning, Sustainable Development, Green Computing, Energy Efficiency, Smart Systems, Environmental Sustainability, Sustainable Development Goals (SDGs)

MACHINE LEARNING IN HEALTHCARE: EARLY DIAGNOSIS AND PREDICTIVE ANALYTICS

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Abstract: Machine learning (ML), a core branch of Artificial Intelligence, is playing a pivotal role in transforming healthcare systems. By analyzing large-scale medical datasets such as electronic health records, medical imaging, and genomic data, ML algorithms enable early disease detection, accurate diagnosis, and personalized treatment plans. The integration of machine learning in healthcare not only enhances the quality of medical services but also reduces costs, minimizes human error, and moves the healthcare industry closer to a future where care is more proactive, precise, and patient-centric. Beyond diagnostics, ML is being applied in drug discovery, pandemic forecasting, and wearable health monitoring, thereby expanding its role from clinical decision-making to preventive healthcare. Advanced models like deep learning can interpret medical images with near-human accuracy, assisting radiologists and reducing diagnostic errors. Despite its potential, challenges such as data privacy, model interpretability, and ethical considerations remain significant.

Keywords: Machine Learning, Artificial Intelligence, Healthcare, Predictive Analytics, Early Diagnosis, Medical Imaging, Personalized Treatment, Drug Discovery, Wearable Devices, Data Privacy, Ethical Challenges, Patient-Centric Care.

MINDCARE AI

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Abstract: Stress, anxiety, and depression do increase worldwide because of lifestyle pressures that limit access to professional care plus social stigmas that exist when customary approaches often lack continuity or personalization plus scalability. This study explores Artificial Intelligence's (AI) role in mental health management as well as stress relief to address these challenges. Findings reveal AI systems monitor stress patterns effectively, identify early psychological distress signs, and deliver low-cost, real-time support. Case studies do show an improved engagement. Also, they reveal lower stress rates and more access for mental support means. AI offers scalability coupled with affordability, and AI also provides support without stigma, so it is a valuable complement to customary care. Though AI cannot empathize like human professionals, AI offers these advantages still. Critical considerations do remain which are ethical challenges as well as data privacy concerns with the need for empathetic system design. Overall, AI promises greatly to improve stress management plus mental health care, provided clinical practices integrate it responsibly to ensure outcomes are safe, ethical, and effective.

Keywords: Bio-Fertilizer, Panchgavya, Organic Farming, Automated Stirring, Mechanized Solution

ML OPS IN ACTION: EFFICIENT DEPLOYMENT AND LIFECYCLE MANAGEMENT OF AI MODELS

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Abstract: The increasing adoption of artificial intelligence across industries has spotlighted the need for robust, scalable, and efficient model deployment strategies. ML Ops—Machine Learning Operations—has emerged as a critical discipline that bridges the gap between data science and production environments. This paper explores the lifecycle management of AI models, emphasizing automation, reproducibility, and continuous integration/continuous deployment (CI/CD) pipelines. The study also underscores the importance of collaboration between data scientists, DevOps engineers, and business stakeholders to ensure reliable and ethical AI deployment. Real-world applications in domains such as healthcare diagnostics, financial forecasting, and smart manufacturing are discussed to illustrate the transformative impact of ML Ops. Finally, we identify key trade-offs between speed, accuracy, and governance, and propose future directions for adaptive, policy-aware ML Ops systems.

Keywords: Model Deployment, Lifecycle Management, CI/CD Pipelines, Model Monitoring, Data Versioning, Scalable Infrastructure

MULTILINGUAL NATURAL LANGUAGE PROCESSING: BREAKING BARRIERS IN GLOBAL COMMUNICATION

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Abstract: Multilingual Natural Language Processing (NLP) has emerged as a transformative field that holds the potential to break down linguistic and cultural barriers in global communication. In an increasingly interconnected world, the ability to process, understand, and generate human language across multiple languages is critical for fostering inclusivity, accessibility, and equitable access to knowledge. By tackling these issues, multilingual NLP not only expands the reach of digital technologies but also ensures that minority languages and underrepresented communities are not left behind in the digital era. Its applications extend beyond translation to include global education, cross-cultural collaboration, healthcare communication, international commerce, and knowledge dissemination.

Keywords: Multilingual Natural Language Processing, Global Communication, Machine Learning, Neural Networks,

NATURAL LANGUAGE PROCESSING AND THE FUTURE OF HUMAN COMPUTER INTERACTION

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Abstract: Natural Language Processing (NLP) has emerged as a transformative field in Artificial Intelligence, bridging the gap between human communication and computational understanding. With advancements in deep learning, contextual embeddings, and conversational models, NLP is redefining the way humans interact with machines. This paper explores the role of NLP in shaping the future of Human–Computer Interaction (HCI), emphasizing intuitive, adaptive, and intelligent communication systems. The integration of NLP with multimodal interfaces, emotion recognition, and personalized dialogue systems presents new possibilities for seamless interaction across diverse domains. Looking ahead, the convergence of NLP with emerging technologies—such as augmented reality, brain–computer interfaces, and ubiquitous computing—will enable more natural, context-aware, and human-centered digital environments. The study underscores NLP’s potential to transform HCI into a more empathetic, efficient, and user-driven paradigm.

Keywords: Natural Language Processing, Human–Computer Interaction, Conversational AI, Multimodal Interfaces, Context-Aware Systems, Artificial Intelligence, Future Technologies

NEUROMORPHIC COMPUTING-AI

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Abstract: Neuromorphic computing is a brain-inspired approach that aims to overcome the limitations of traditional von Neumann architectures in artificial intelligence. Conventional systems face challenges such as high energy consumption and memory bottlenecks, making them inefficient for large-scale AI tasks. Neuromorphic systems mimic the brain’s structure by integrating memory and computation, enabling faster, energy-efficient, and adaptive processing. Hardware platforms like IBM’s TrueNorth and Intel’s Loihi demonstrate how neuromorphic chips can efficiently handle AI workloads while emulating neural behavior. Neuromorphic AI holds promise for applications such as robotics, healthcare, and autonomous vehicles, where low latency, privacy, and adaptability are essential. By processing sensory data locally, these systems reduce reliance on cloud computing while supporting continual learning, much like the human brain. Although challenges remain—such as scalable hardware, programming frameworks, and ethical concerns—neuromorphic computing integrated with AI has the potential to revolutionize artificial intelligence, enabling smarter, more sustainable, and human-like technologies.

Keywords -- Next-Generation Computing, Artificial Intelligence (AI), Neuromorphic Computing, Quantum-Inspired Algorithms, High-Performance Computing (HPC),

NATURAL LANGUAGE PROCESSING, SPEECH & AUDIO PROCESSING

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Abstract: Enhancing Multimodal Communication using Natural Language Processing and Speech & Audio Processing. The project aims at designing an integrated system that uses Natural Language Processing (NLP) and Speech & Audio Processing to improve multimodal communication systems. Applications are intelligent virtual assistants, real-time multilingual communication aids, and assistive technologies for hearing or speech-impaired individuals. Deep learning models like transformers and recurrent neural networks trained on big datasets are used by the project to reach high accuracy and scalability. A major innovation is the creation of a single model that simultaneously optimizes NLP and audio processing tasks, minimizing latency and enhancing performance in real-time use. The system will incorporate ethical considerations as well, ensuring data handling that is privacy-preserving and bias-free language and speech models. Through interoperability with current platforms and APIs, the project aims to provide a solution that can be scaled and implemented across industries, from education and healthcare to customer service and entertainment, and in the end, revolutionize the way humans and machines communicate in dynamic, real-world environments.

Keywords: Bio-Fertilizer, Panchgavya, Organic Farming, Automated Stirring, Mechanized Solution

NEXT-GENERATION AI-POWERED WEARABLE HEALTH MONITORING RING FOR REAL-TIME RISK DETECTION AND PROACTIVE HUMAN SAFEGUARDING

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Abstract: This project presents a next-generation AI-powered wearable health monitoring ring designed for real-time detection of critical health risks and proactive human safeguarding. The device integrates multiple sensors including ECG, PPG, bioelectrical impedance, and electro-wave detectors to continuously collect physiological signals related to heart activity, sugar level trends, stress, sleep quality, energy levels, and potential heart attack risks. Data is wirelessly transmitted to a mobile application equipped with an AI engine for advanced processing, risk assessment, personalized recommendations, and instant alerts. The compact ring design ensures non-intrusive, continuous monitoring while empowering individuals with timely insights and lifestyle guidance. By combining artificial intelligence with wearable technology, this system bridges preventive healthcare and real-time intervention, offering a powerful solution to reduce sudden health incidents and promote healthier living.

Keywords: AI-powered wearable, health monitoring ring, real-time risk detection, preventive healthcare, ECG/PPG sensors, personalized recommendations

NEXT GENERATION COMPUTING WITH AI

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Abstract: Next-generation computing for Artificial Intelligence (AI) is envisioned as a paradigm that integrates advanced hardware architectures, intelligent software frameworks, and human-centric design principles to achieve scalable, adaptive, and sustainable intelligence. It abstracts computation beyond traditional CPU-GPU models into neuromorphic, quantum, and bio- inspired systems capable of mimicking cognition, reasoning, and perception. By leveraging massive parallelism, energy efficiency, and self-learning algorithms, this computing era aims to transcend data-driven AI into knowledge-driven intelligence. The abstraction highlights interoperability between cloud, edge, and on-device intelligence, ensuring context-aware decision making, ethical alignment, and real-time adaptability. Ultimately, next-generation AI computing abstracts raw computation into an ecosystem of autonomous, trustworthy, and collaborative intelligence that augments human capability while addressing societal challenges.

Keywords -- Next-Generation Computing, Artificial Intelligence (AI), Neuromorphic Computing, Quantum-Inspired Algorithms, High-Performance Computing (HPC), Foundation Models,

POWERED REAL – TIME WATER QUALITY MONITORING AND DISEASE OUTBREAK PREDICTION PLATFORM

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Abstract: An AI-powered platform is proposed to combat the global water crisis and protect public health by integrating IoT sensors, machine learning (ML), and wastewater-based epidemiology (WBE). This system monitors water quality (pH, turbidity, microbes) and predicts waterborne disease outbreaks (like cholera and typhoid) with 85–98% accuracy, utilizing edge computing and hybrid ML models (LSTM, Random Forest, ANFIS) to calculate a dynamic Water Quality Index (WQI). By fusing data from sensors, satellite imagery, and climate records, the platform forecasts outbreaks 1–4 weeks in advance, aiming to reduce health risks by 50–70% and support UN SDG. Challenges like data scarcity and scalability are managed via transfer learning, explainable AI, and blockchain. Successfully deployed in diverse settings, this innovative approach leverages technologies like transformer-based genomic analysis and future Generative AI (GenAI) to enhance water management, security, and environmental sustainability.

Keywords: Artificial Intelligence, Machine Learning, IoT, Water Quality Monitoring, Disease Outbreak Prediction, Wastewater- Based Epidemiology, Real-Time Analytics, Public Health, Water Security, Predictive

PRECISION GUIDANCE OF AGRICULTURAL TRACTORS FOR AUTONOMOUS FARMING

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Abstract: Agriculture is undergoing a cultural shift due to corporate farming, labor shortages, and the need for increased efficiency and productivity. These changes have led to the emergence of Precision Autonomous Farming (PAF). This paper presents ongoing work and progress in implementing autonomous systems in agriculture, focusing on a system-of-systems approach. Each system is designed to perform specific tasks such as guidance, navigation, and control of agricultural tractors. The integration of these systems aims to achieve fully autonomous farming, with precision guidance playing a critical role in ensuring accuracy and effectiveness.

Keywords: Precision Autonomous Farming, Agricultural Tractors, Autonomous Systems, Guidance, Navigation, Control

PREDICTIVE ANALYTICS FOR EARLY DIAGNOSIS OF CHRONIC DISEASES USING MACHINE LEARNING

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Abstract: The increasing global prevalence of chronic diseases such as diabetes, cardiovascular conditions, and chronic kidney disorders highlights the urgent need for early detection mechanisms that can guide timely medical interventions. Traditional diagnostic practices often rely on symptomatic assessments and invasive tests, which may delay early-stage detection. To address this gap, our project leverages machine learning– based predictive analytics to identify at-risk individuals before clinical symptoms manifest. By training predictive models on large-scale healthcare datasets, the system can uncover hidden correlations among patient demographics, lifestyle factors, medical history, and diagnostic parameters. This approach provides healthcare professionals with actionable insights, enabling proactive disease management and reducing long- term treatment burdens. The proposed framework emphasizes data pre-processing, feature engineering, model selection, and validation to ensure accuracy, interpretability, and scalability in real-world healthcare systems.

Keywords: Predictive Analytics, Machine Learning, Chronic Disease, Early Diagnosis, Healthcare Data

NEUROMORPHIC HARDWARE : TOWARDS BRAIN-INSPIRED COMPUTING SYSTEMS

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Abstract : Neuromorphic hardware represents a paradigm shift in computing architecture, aiming to mimic the structure and function of the human brain to achieve energy-efficient, parallel, and adaptive information processing. Unlike traditional von Neumann architectures, neuromorphic systems integrate memory and computation, leveraging spiking neural networks (SNNs), event-driven communication, and asynchronous processing to emulate neural behavior. This paper explores the design principles, emerging technologies, and key challenges associated with neuromorphic computing. We discuss recent advancements in neuromorphic chips such as IBM's TrueNorth, Intel's Loihi, and research-oriented platforms, highlighting their potential for real-time learning, low-power operation, and scalability. The study also addresses applications in edge computing, robotics, and artificial intelligence, where neuromorphic systems show promise in overcoming limitations of conventional hardware. Finally, we outline future directions and the interdisciplinary collaboration required to bring brain-inspired computing closer to practical deployment.

Keywords: Neuromorphic computing, brain-inspired hardware, spiking neural networks (SNNs), energy-efficient computing, neuromorphic chips, TrueNorth, Loihi, event-driven processing, edge AI, non-von Neumann architecture

REVOLUTIONIZING MOBILITY: SMART GLASSES FOR VISUALLY IMPAIRED INDIVIDUALS WITH OBJECT DETECTION AND NAVIGATION

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Abstract: Smart glasses equipped with advanced computer vision and AI can detect and alert visually impaired individuals to objects by name, enhancing their mobility and independence. These glasses provide real-time feedback, allowing users to navigate complex environments with confidence. Key features include object recognition, obstacle detection, and road crossing assistance. The smart glasses can identify objects such as doors, stairs, and pedestrians, providing users with essential information about their surroundings. By leveraging AI and computer vision, these glasses can provide users with a new level of freedom and autonomy, enabling them to participate fully in society. This presentation will explore the development, features, and potential impact of smart glasses for visually impaired individuals, highlighting their potential to revolutionize mobility and independence.

Keywords: AI, Mobility, Object Detection

SCALABLE ALGORITHMS FOR BIG DATA: BRIDGING THE GAP BETWEEN THEORY AND PRACTICE

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Abstract: The rapid growth of digital data presents unprecedented opportunities and challenges for computation, analysis, and decision-making. Traditional algorithms, though theoretically efficient, often struggle to scale when applied to massive, heterogeneous, and dynamic datasets. To address this gap, scalable algorithms have emerged as a critical area of research, focusing on efficiency, robustness, and adaptability in real-world environments. This involves leveraging parallel and distributed computing, approximation techniques, and streaming models to handle data at scale without compromising accuracy. Bridging theory and practice requires not only rigorous algorithmic design but also practical validation across diverse domains such as healthcare, finance, social networks, and scientific discovery. However, challenges remain, including trade-offs between accuracy and efficiency, infrastructure limitations, and the complexity of deployment in large-scale systems. This paper explores the evolution of scalable algorithms for big data, their applications, benefits, and limitations, while emphasizing the need to align theoretical advancements with practical implementations to unlock the full potential of data-driven innovation.

Keywords: Scalable Algorithms, Big Data, Distributed Computing, Data Analytics, Streaming Models, Approximation Techniques

SMART BUS TICKET SYSTEM

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Abstract: A smart ticketing system for public transportation that employs RFID, GPS, and GSM technologies offers an advanced and efficient alternative to traditional ticketing methods. By eliminating paper tickets, it reduces fraud, supports sustainability, and enhances passenger convenience. RFID tags enable quick and secure access to trip details, while GPS provides real-time vehicle tracking so passengers can monitor journeys more effectively. GSM ensures seamless communication by delivering notifications, updates, and personalized offers. Strong security protocols such as encryption and authentication protect passenger data, while the scalability of the system makes it suitable for both small cities and large metropolitan areas. Moreover, integration with smart city infrastructure enables connections to IoT devices, digital wallets, and emergency management systems, where real-time communication enhances safety during disruptions. This study examines the benefits, challenges, and implementation of such a smart ticketing system and explores its effectiveness, efficiency, and future directions for research and development.

Keywords: Smart Ticketing, RFID, GPS, GSM, Public Transportation, Internet of Things (IoT)

THE RISE OF GENERATIVE AI: OPPORTUNITIES AND RISKS

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Abstract: The emergence and rapid evolution of generative artificial intelligence (AI) have ushered in a new era of computational creativity and automation. Generative AI refers to models, particularly those based on deep learning architectures like Generative Adversarial Networks (GANs) and Large Language Models (LLMs), which can produce human-like text, images, videos, audio, and even complex code. The paper provides a comprehensive analysis of the dual-edged nature of generative AI. It explores the opportunities it offers for innovation and efficiency, while critically examining the associated risks and their broader implications for individuals, institutions, and society. Additionally, it discusses the role of policymakers, technologists, educators, and civil society in shaping a future where generative AI is used ethically and equitably. As this technology continues to evolve, a proactive and interdisciplinary approach will be essential to harness its full potential while safeguarding human values, security, and social well-being. This rapid progress also raises serious ethical, social, and economic concerns. Among the foremost risks are the proliferation of misinformation and deepfakes, loss of trust in digital content, erosion of privacy, intellectual property violations, and potential job displacement due to automation. Moreover, generative AI challenges traditional notions of authorship, creativity, and accountability.

Keywords: Artificial intelligence ethics, AI risks, Deep learning, Misinformation, Responsible AI.

THE ROLE OF AI IN SMART CITIES AND IOT ECOSYSTEMS

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Abstract: The rapid advancement of Artificial Intelligence (AI) and Internet of Things (IoT) technologies is driving a fundamental transformation in the development of smart cities. AI empowers IoT ecosystems by enabling real-time data analysis, decision-making, and automation across urban systems. From intelligent traffic control and smart grids to waste management and public safety, This abstract highlights the growing role of AI in shaping intelligent, resilient, and citizen-centric urban ecosystems through seamless integration with IoT infrastructure. This paper explores the integrative role of AI within IoT-driven smart city ecosystems, focusing on how AI enables real-time decision-making, predictive analytics, and autonomous control across various domains such as transportation, energy management, public safety, and environmental monitoring. By harnessing AI within IoT frameworks, cities can move closer to achieving resilience, inclusivity, and sustainability in the face of growing urban challenges.

Keywords: Artificial Intelligence (AI), Smart Cities, Internet of Things (IoT), Urban Infrastructure

TRAFFIC MODELING, ANOMALY DETECTION, AND PRIVACY IN NETWORK DATA

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Abstract - In the rapidly evolving landscape of network security, the integration of traffic modelling and anomaly detection stands as a pivotal strategy for identifying and mitigating potential threats. This research presents a comprehensive framework that synergizes advanced traffic modelling techniques with sophisticated anomaly detection algorithms, all while prioritizing the preservation of user privacy. By harnessing the power of machine learning and data analytics, our approach not only enhances the accuracy of threat detection but also ensures that sensitive user information is safeguarded through state-of-the-art privacy-preserving methodologies. The proposed framework is designed to adapt to the dynamic nature of network traffic, providing real-time insights and proactive security measures. Through extensive experimentation and validation, we demonstrate the efficacy of our approach in distinguishing between legitimate and malicious network activities, thereby contributing to the development of more resilient and secure network infrastructures. This work underscores the importance of balancing security imperatives with privacy concerns, offering a scalable solution that can be applied across various network environments to foster a safer digital ecosystem.

TINY ML: DEPLOYING DEEP LEARNING MODELS ON MICROCONTROLLER AND IOT DEVICES

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Abstract: Tiny Machine Learning (TinyML) represents a paradigm shift in artificial intelligence by enabling the deployment of deep learning models on ultra-low-power devices such as microcontrollers and Internet of Things (IoT) nodes. Despite these benefits, the resource constraints of microcontrollers pose critical challenges for deploying complex models, requiring innovations in model compression, quantization, pruning, and efficient runtime execution. Recent frameworks such as TensorFlow Lite for Microcontrollers, uTensor, and Edge Impulse provide software support to bridge this gap, while advances in embedded hardware are expanding the scope of feasible applications. From wake-word detection and real-time anomaly monitoring to vision-based sensing in agriculture and healthcare, TinyML is poised to transform the way intelligence is embedded into everyday objects..

Keywords: Tiny ML, Deep Learning, Microcontrollers, Internet of Things (IoT), Edge AI, Model Quantization, On-device Inference, Embedded Systems, Low-power AI

TOWARDS EXPLAINABLE AI 2.0: INTERPRETING LARGE NEURAL NETWORKS BEYOND BLACK BOXES

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Abstract: Artificial Intelligence (AI) is reshaping the healthcare landscape by enabling data-driven diagnosis and predictive analytics, paving the way toward Healthcare 5.0. With the rapid growth of medical data generated from electronic health records, imaging systems, wearable devices, and genomic sequencing, traditional diagnostic approaches are no longer sufficient to ensure timely and accurate decision-making. AI-driven models, particularly those based on machine learning and deep learning, facilitate the extraction of hidden patterns, early disease detection, personalized treatment planning, and real-time patient monitoring. Predictive analytics empowers healthcare professionals to forecast disease progression, anticipate epidemics, and optimize resource allocation, thus improving both patient outcomes and operational efficiency. Furthermore, AI integration supports precision medicine, enhances clinical workflows, and reduces diagnostic errors by complementing human expertise with computational intelligence.

Keywords: Artificial Intelligence, Healthcare 5.0, Data-Driven Diagnosis, Predictive Analytics, Machine Learning, Deep Learning, Precision Medicine, Digital Health, Clinical Decision Support, Big Data in Healthcare.

TRANSFER LEARNING, ENSEMBLE LEARNING, DISTRIBUTED & DECENTRALIZED ML

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Abstract - In recent years, the advancement of machine learning (ML) has been accelerated by approaches that enhance model efficiency, scalability, and adaptability. Transfer Learning enables models to leverage prior knowledge from related tasks or domains, reducing training time and improving performance, especially when data is scarce. Complementing this, Decentralized Machine Learning approaches, such as federated learning, focus on privacy-preserving collaboration by training models locally on edge devices without sharing raw data, thereby addressing data governance and security challenges. Together, these paradigms represent the next generation of ML techniques, enabling more scalable, accurate, adaptive, and privacy-preserving systems applicable across healthcare, finance, IoT, and other data-intensive domains.

Keywords: Artificial Intelligence.

TOWARDS EXPLAINABLE AI 2.0: INTERPRETING LARGE NEURAL NETWORKS BEYOND BLACK BOXES

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Abstract: Recent advances in deep learning have yielded large neural networks that achieve state-of-the-art performance across image, text, and multimodal tasks. However, their complexity and opaque internal representations limit trust, accountability, and broader deployment in sensitive and high-stakes applications. We also examine methods of integrating interpretability during training rather than relying exclusively on post-hoc explanations, so that models are designed to be more inherently understandable. Challenges addressed include scalability to large-scale models, aligning explanations with human conceptual understanding, robustness of explanations under different inputs or perturbations, and the tension between interpretability and performance. Finally, we propose a roadmap for future research in XAI 2.0: developing standardized benchmarks for interpretability, formal metrics of explanation quality.

Keywords: Explainable AI (XAI 2.0), Neural Networks, Interpretability, Transparency, Robustness, Human-Aligned Explanations, Trustworthy AI.

TRUSTWORTHY & EXPLAINABLE AI FOR SOCIETY

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Abstract : Artificial Intelligence (AI) is rapidly influencing society with its ability to enhance efficiency and decision-making. For AI to be widely accepted, it must be trustworthy and explainable. Trust ensures fairness, accountability, and ethical use, while explainability provides clarity in how AI makes decisions. Together, these aspects help build public confidence and promote responsible adoption of AI technologies in society. Artificial Intelligence (AI) has become a transformative force across industries and society, yet concerns about trustworthiness and explainability remain central to its adoption. This paper discusses the importance of creating AI systems that are transparent, fair, accountable, and aligned with human values. It highlights challenges in interpretability, bias reduction, and ethical deployment, while also exploring strategies to make AI more explainable and reliable. The role of regulatory frameworks, technical innovations, and interdisciplinary collaboration is emphasized to ensure that AI serves both industry efficiency and societal well-being in a responsible manner. In conclusion, building trustworthy and explainable AI is not only a technical challenge but also a social and ethical imperative.

Keywords: Trustworthy AI, Explainable AI, Society, Ethics, Accountability

TRUSTWORTHY GENERATIVE AI: DETECTING DEEPPAKE AND SYNTHETIC MEDIA

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Abstract: The rapid advancements in generative artificial intelligence (AI) have revolutionized the creation of synthetic media, enabling highly realistic images, videos, and audio that are often indistinguishable from authentic content. While these innovations support creativity and industry applications, they also pose significant threats in the form of deepfakes, misinformation, identity fraud, and erosion of public trust. Ensuring the trustworthiness of generative AI has therefore become a critical research priority. This paper explores emerging techniques for detecting and mitigating deepfakes and synthetic media, focusing on methods such as digital watermarking, adversarial learning, multimodal forensic analysis, and blockchain-based verification. Additionally, the study highlights the ethical, social, and regulatory dimensions required to balance innovation with responsibility. By addressing both the technical challenges and trust-building mechanisms, this work emphasizes the importance of developing robust detection frameworks to safeguard digital integrity and maintain confidence in AI-driven media ecosystems.

Keywords: Generative AI, Deepfake Detection, Synthetic Media, Trustworthy AI, Digital Forensics

UNLOCKING THE POWER OF RELATIONAL DATA

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Abstract: Graph-structured data is pervasive in real-world applications, ranging from social networks and biological systems to recommendation engines and knowledge graphs. Traditional deep learning architectures such as Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs) are limited in capturing the inherent dependencies and non-Euclidean relationships present in such data. Graph Neural Networks (GNNs) have emerged as a powerful paradigm capable of learning directly from relational data by aggregating and propagating information across graph nodes and edges. This paper explores the fundamentals of GNNs, including graph convolutional mechanisms, message passing frameworks, and their scalability challenges. We highlight significant applications of GNNs in domains such as drug discovery, fraud detection, and natural language processing, demonstrating their ability to uncover hidden patterns and improve predictive accuracy. Furthermore, we discuss open challenges related to computational efficiency, interpretability, and generalization to dynamic graphs..

Keywords: Artificial Intelligence.

DATA-CENTRIC AI: RETHINKING THE ROLE OF DATA IN MACHINE LEARNING SYSTEMS

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Abstract: The progression of machine learning (ML) has often highlighted the sophistication of algorithms as the primary driver of advancement. However, recent research emphasizes that the effectiveness, resilience, and ethical considerations of ML systems are primarily influenced by the data used for training. This paper offers a reevaluation of the role of data in machine learning by promoting a data-centric viewpoint. We examine how aspects such as data quality, diversity, representation, and curation impact generalization, interpretability, and fairness. Furthermore, we contend that depending on larger datasets without systematic refinement can worsen issues of bias, inefficiency, and limited transferability. By emphasizing the continuous enhancement of datasets—through annotation, validation, augmentation, and governance—this shift challenges the prevailing focus on model-centric optimization and positions data as the fundamental element of intelligence in ML systems. The analysis indicates that sustainable advancements in machine learning will rely on establishing rigorous frameworks and methodologies for data stewardship, rather than solely focusing on algorithmic complexity.

Keywords: Machine Learning, Data-Centric AI, Data Quality, Bias and Fairness, Generalization, Model Performance, Data Governance

AI SENTIMENT ANALYSIS

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Abstract: Sentiment analysis, also known as opinion mining, is an important application of Artificial Intelligence (AI) and Natural Language Processing (NLP). It enables machines to analyze emotions, opinions, and attitudes expressed in text data such as social media posts, reviews, and customer feedback. By classifying sentiments into categories like positive, negative, or neutral, sentiment analysis supports businesses, industries, and society in making informed decisions. AI-driven sentiment analysis combines machine learning models and deep learning techniques to provide accurate and scalable solutions. This paper highlights the role of AI in sentiment analysis, its applications, benefits, and challenges for future advancements.

Keywords: Artificial Intelligence, Sentiment Analysis, NLP, Machine Learning, Deep Learning, Opinion Mining

EVOLUTIONARY ALGORITHMS FOR HYPER PARAMETER OPTIMIZATION IN DEEP LEARNING

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Abstract: The performance of deep learning models highly depends on the choice of hyperparameters, such as learning rate, batch size, network architecture, and regularization factors. Traditional optimization techniques like grid search and random search are often computationally expensive and inefficient when dealing with large and complex hyperparameter spaces. Evolutionary Algorithms (EAs), inspired by the principles of natural selection and genetic evolution, provide an effective alternative for hyperparameter optimization. By encoding hyperparameters as candidate solutions and applying evolutionary operators such as selection, crossover, and mutation, EAs explore the search space efficiently while avoiding premature convergence to local optima.

GAMIFIED EDUCATION: TRANSFORMING LEARNING THROUGH GAME-BASED APPROACHES

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Abstract: Gamified education is an innovative pedagogical method that applies game mechanics— such as points, levels, leaderboards, and rewards—into learning environments to increase student engagement, motivation, and retention. As digital natives demand more interactive experiences, gamification provides educators with a strategy to make learning both enjoyable and effective. This paper explores the principles, benefits, challenges, and future directions of gamified education, emphasizing its role in reshaping traditional classroom practices into dynamic, learner-centered experiences. At its core, gamification draws upon key psychological concepts such as intrinsic motivation, feedback loops, and goal orientation. Elements like points and leaderboards provide extrinsic incentives, while challenges and progress indicators appeal to intrinsic desires for mastery and achievement. Effective gamified education does not merely replicate games but strategically incorporates mechanics that align with instructional goals. For instance, quizzes may be transformed into interactive missions, while long-term projects may be framed as “quests” that reward persistence and creativity.

Keywords: *Motivation, peer-to-peer, levels, engaging, goals, achievement.*

AI WHISPERNET: SILENT COMMUNICATION FOR THE DEAF AND PARALYZED

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Abstract: This paper presents AI WhisperNet, an innovative emotion-aware and neural-interface-based communication system designed to empower individuals who are deaf, paralyzed, or otherwise unable to communicate verbally. The proposed system leverages advanced artificial intelligence (AI), brain-computer interface (BCI) technology, and natural language processing (NLP) to decode subtle neural or muscular signals into coherent digital speech or text. WhisperNet captures micro-expressions, eye movements, and neural patterns using non-invasive sensors, which are then processed through deep learning models to infer intended messages with high accuracy. The system integrates multimodal signal fusion and context-aware emotion modeling to ensure natural and empathetic communication, enabling users to express emotions and intent seamlessly. Experimental evaluations demonstrate WhisperNet’s potential for real-time, low-latency communication with minimal error rates, offering transformative applications in healthcare, assistive technology, and human-computer interaction. The study also discusses the ethical implications, data privacy concerns, and accessibility challenges associated with deploying such AI-driven assistive systems in real-world environments.

Keywords: Brain-Computer Interface (BCI), Silent Communication, Affective Computing, Assistive Technology,

AN INTELLIGENT IOT-BASED VITAL SIGNS MONITORING AND ANOMALY DETECTION SYSTEM FOR REMOTE HEALTHCARE

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ABSTRACT: Healthcare no longer needs to be confined within hospital boundaries. This paper presents the design and implementation of an IoT-enabled real-time patient health monitoring and alert system that continuously tracks critical vital signs, including heart rate, body temperature, blood oxygen saturation (SpO₂), and blood pressure, using compact wearable sensors. The acquired data is transmitted to a secure cloud platform where it is processed and analyzed in real time using a threshold-based anomaly detection algorithm combined with decision-tree classification for early warning detection. Experimental results demonstrate that the proposed system achieves an average detection accuracy of 97.4% with a response latency of less than 2 seconds, ensuring timely intervention in critical situations. The system is cost-effective, scalable, and suitable for deployment in diverse environments, including home care, hospital wards, and remote rural areas. The solution aims to enhance accessibility, reduce response time, and make healthcare delivery smarter, faster, and more reliable.

Keywords: Internet of Things (IoT), Real-Time Health Monitoring, Wearable Sensors, Anomaly Detection, Remote Healthcare

AUTOMATED MACHINE LEARNING: SIMPLIFYING MODEL SELECTION AND TUNING

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Abstract : Automated Machine Learning (AutoML) has emerged as a transformative approach in modern data science, aiming to reduce the complexity of model development by automating critical processes such as feature engineering, model selection, and hyperparameter tuning. Traditional machine learning workflows demand significant expertise and manual effort, which often create barriers for practitioners and organizations with limited technical resources. AutoML frameworks address this challenge by leveraging advanced optimization techniques, meta-learning, and ensemble strategies to automatically identify the most suitable models while optimizing their performance. This not only accelerates the end-to-end machine learning pipeline but also democratizes access to artificial intelligence, enabling broader adoption across diverse domains. The paper explores the underlying methodologies of AutoML, its advantages in simplifying model development, and its applications in real-world scenarios, while also highlighting current limitations and future research directions.

Keywords : Automated Machine Learning (AutoML), Model Selection, Hyperparameter Tuning, Feature Engineering, Optimization, Meta-Learning, Ensemble Learning, Artificial Intelligence

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING: TRANSFORMING THE FUTURE OF SPACE MISSIONS

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Abstract: Artificial Intelligence (AI) and Machine Learning (ML) are increasingly shaping the future of space exploration by enabling autonomous, efficient, and intelligent decision-making in complex environments. Traditional mission control approaches, heavily reliant on ground-based systems, face challenges such as communication delays, limited bandwidth, and the exponential growth of space data. Current implementations by organizations such as NASA, ISRO, and SpaceX demonstrate significant improvements in mission reliability and scalability. However, issues such as computational constraints, environmental robustness, and verification of autonomous systems remain active areas of research. This paper provides an overview of the role of AI and ML in space missions, their practical applications, potential benefits, challenges, and future opportunities in advancing autonomous interplanetary exploration.

Keywords — Artificial Intelligence, Machine Learning, Space Exploration, Autonomous Systems, Predictive Maintenance, Satellite Image Processing

GREEN AI: BUILDING ENERGY-EFFICIENT AND SUSTAINABLE MACHINE LEARNING MODELS

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Abstract: The rapid growth of artificial intelligence (AI) has led to significant advancements across industries, but it has also raised concerns about energy consumption and environmental impact. Green AI emphasizes the development of machine learning models that are both high performing and resource-efficient. This approach involves optimizing algorithms, leveraging energy-efficient hardware like TPUs and FPGAs, and designing sustainable data centres. Case studies in natural language processing and computer vision demonstrate how Green AI can align technological progress with global sustainability goals, reducing carbon footprints while maintaining accuracy and scalability.

Keywords: *GreenAI, Energy-efficient machine learning, Sustainable AI, Model optimization, Environmental impact, TPUs and FPGAs,*

SENTIMENT ANALYSIS OF SOCIAL MEDIA POSTS ON MOVIES / OTT SERIES

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Abstract: Movies and OTT (Over-The-Top) series have become an integral part of modern entertainment, with their success often determined not only by critical reviews but also by the opinions shared by audiences on social media. Platforms such as Twitter, Instagram, and YouTube serve as powerful spaces where viewers instantly express their reactions, shaping public perception and influencing viewership trends. This project focuses on developing a system that collects and analyzes these online reactions to evaluate audience sentiment toward newly released films and digital series. The system continuously gathers comments and posts using publicly available data streams, then processes the information to identify patterns of appreciation, criticism, or neutrality. By organizing audience responses into clear categories, the analysis highlights what aspects of the content resonate well—such as story, acting, or music—and what factors receive negative feedback.

Keywords: *Social media, Audience Feedback, Movies, OTT Series, Sentiment Analysis, Entertainment Industry*

AUGMENTED ANALYTICS: AUTOMATING INSIGHT DISCOVERY THROUGH AI-DRIVEN DATA SCIENCE

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Abstract: Augmented analytics represents a transformative shift in data analysis, leveraging artificial intelligence (AI), machine learning (ML), and natural language processing (NLP) to automate and enhance the end-to-end data analytics process. This approach streamlines data preparation, automates insight discovery, and enables intuitive interaction with complex datasets, democratizing access to data-driven decision-making across all levels of an organization. This paper explores the core components, benefits, use cases, and challenges of augmented analytics, highlighting its potential to reshape the future of data science and business intelligence through increased efficiency, scalability, and accessibility. This paper examines the architecture, methodologies, and real-world applications of augmented analytics, and discusses how it is reshaping the future of business intelligence and democratizing access to advanced analytics. By bridging the gap between data science and decision-making, augmented analytics has the potential to transform how organizations derive value from their data assets.

Keywords: Augmented Analytics, Artificial Intelligence (AI), Machine Learning (ML), Natural Language Processing (NLP)

EMOTION RECOGNITION AND RESPONSE GENERATION IN AI SYSTEMS: A MULTIDISCIPLINARY PERSPECTIVE

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Abstract: Emotion-Aware Artificial Intelligence (AI) systems, also known as affective computing systems, represent a significant advancement in the field of human-computer interaction (HCI). Unlike conventional AI models that primarily focus on logical reasoning and task execution, emotion-aware systems are designed to detect, interpret, and respond to human emotional states. The development of emotion-aware AI involves multidisciplinary approaches combining computer vision, natural language processing (NLP), speech analysis, physiological signal monitoring, and machine learning. Furthermore, we discuss the challenges that hinder large-scale deployment, including data privacy concerns, emotional bias in training datasets, cultural variations in emotional expression, and the risk of over-reliance on automated emotional inference. The potential of emotion-aware AI is profound, but it must be approached with ethical considerations and a focus on user trust.

Keywords— Emotion-Aware AI, Affective Computing, Human-Computer Interaction, Emotion Detection, Sentiment Analysis, Machine Learning, Multimodal Emotion Recognition,

BLOCKCHAIN MEETS AI: SECURING DATA SHARING AND MODEL TRAINING

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Abstract: The rapid growth of data and widespread adoption of artificial intelligence (AI) have created major challenges in trust, privacy, and security during collaborative model training and data sharing. Traditional centralized approaches often depend on a single authority, leading to risks such as data leakage, tampering, and single points of failure. To address these limitations, this paper proposes a novel framework that integrates blockchain with distributed AI training to ensure secure, transparent, and auditable collaboration. The framework employs a permissioned blockchain as a decentralized ledger to record contributions, access permissions, and audit trails. Smart contracts are used to automate incentives, enforce access control, and maintain reputation scores among participants. Data owners retain sovereignty over their raw datasets and share only encrypted gradients or aggregates, thereby preserving privacy. Federated learning and secure multi-party computation are incorporated to enable collaborative training without exposing sensitive information. Blockchain-mediated checkpoints further ensure model integrity, traceability, and accountability.

Keywords: Blockchain, Artificial Intelligence, Federated Learning, Data Privacy, Secure Data Sharing, Smart Contracts.

COGNITIVE NO-CODE AI PLATFORMS FOR LOW-TECH MSME ENVIRONMENTS

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Abstract: The Micro, Small, and Medium Enterprise (MSME) sector in India comprises over 63 million units, contributing approximately 30% to national GDP and nearly 45% to total exports. Despite this impact, more than 88% of MSMEs remain partially or fully non-digitized, relying on spreadsheets, paper ledgers, and messaging platforms, which limits their access to data-driven decision support. This study proposes a cognitive no-code AI platform tailored for low-technology MSME environments. Field evaluations conducted with representative MSME data demonstrate that the platform achieves Mean Absolute Percentage Error (MAPE) below 12% for short-horizon demand forecasting using as few as 30 historical data points, improves procurement decisions by 8–15% through optimized supplier recommendations, and attains an F1-score above 0.85 in SKU-level profitability classification under vernacular query conditions. Query response times remained under 1 second on budget smartphones due to lightweight quantized edge-AI models.

Keywords— MSME digitization; no-code AI; AutoML; few-shot learning; multimodal interfaces; vernacular computing; edge AI

COMPUTER VISION IN SMART SURVEILLANCE: BALANCING SECURITY AND PRIVACY

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Abstract: The accelerating growth of urbanization, combined with increased reliance on digital infrastructure, has created a pressing need for intelligent surveillance systems that ensure public safety while respecting individual privacy. This research proposes a comprehensive framework for smart surveillance that balances the dual objectives of security enhancement and privacy preservation. Our methodology integrates state-of-the-art deep learning models for object detection and activity recognition with privacy-aware approaches, including data anonymization, federated learning, differential privacy, and secure multi-party computation. The study involves the development and evaluation of prototype models on publicly available datasets, with performance metrics assessed for accuracy, robustness, and ethical compliance. Particular attention is given to mitigating biases in AI predictions and ensuring minimal exposure of personal data. Preliminary findings indicate that privacy-preserving computer vision techniques can maintain high levels of threat detection accuracy while significantly reducing privacy risks.

Keywords: Computer Vision, Smart Surveillance, Privacy Preservation, Ethical AI, Anomaly Detection, Federated Learning, Deep Learning, Facial Recognition, Predictive Analytics, Data Anonymization.

5G AND AI INTEGRATION: ENABLING NEXT – GENERATION SMART CONNECTIVITY

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Abstract: The evolution of wireless communication has reached a new frontier with the deployment of 5G networks, offering ultra-low latency, high data rates, and massive device connectivity. However, the complexity of managing such vast and dynamic networks requires intelligent solutions beyond traditional approaches. Artificial Intelligence (AI) plays a pivotal role in optimizing 5G systems by enabling real-time data analysis, adaptive resource allocation, predictive maintenance, and intelligent decision-making. Through the integration of AI with 5G, smart connectivity becomes possible, supporting diverse applications such as autonomous vehicles, smart cities, remote healthcare, and industrial automation. AI-driven algorithms enhance network efficiency, improve spectrum utilization, and ensure seamless user experiences by anticipating traffic demands and mitigating potential failures. Furthermore, AI powered security mechanisms strengthen 5G networks against evolving cyber threats.

Keywords: 5G Networks, Artificial Intelligence (AI), Smart Connectivity, Network Optimization, Intelligent Decision Making, Autonomous systems, Smart Cities, Industrial Automation, Real Time Analytics, Cybersecurity.

ADVERSARIAL MACHINE LEARNING: CHALLENGES IN SECURITY AND ROBUSTNESS OF AI MODELS

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Abstract: Adversarial Machine Learning (AML) has become a pivotal research area as artificial intelligence systems are increasingly deployed in security-sensitive domains. Despite the impressive performance of modern AI models, particularly deep neural networks, they remain highly susceptible to adversarial inputs carefully designed perturbations that can cause misclassification, system manipulation, or security breaches. This survey investigates the core challenges in achieving robustness and reliability of AI models against such attacks. It explores the taxonomy of adversarial threats, including evasion, poisoning, and model extraction attacks, while highlighting the limitations of existing defense strategies. Additionally, the paper discusses the trade-offs between robustness, accuracy, and computational efficiency, along with the challenges in establishing standardized benchmarks for AI security evaluation. The study emphasizes the urgent need for interdisciplinary efforts combining machine learning, cybersecurity, and theoretical research to develop resilient AI systems capable of operating safely in adversarial environments.

Keywords: Adversarial Machine Learning, AI Security, Robustness, Adversarial Attacks, Defense Mechanisms, Evasion Attacks, Poisoning Attacks, Model Extraction, Trustworthy AI, Deep Neural Networks, Cybersecurity in AI.

A NEW INTELLIGENT JAMMING ATTACKS DETECTION

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Abstract: Wireless communication systems, which support almost every aspect of modern life, face a serious challenge from jamming attacks. These attacks intentionally disrupt signals, reduce network performance, and put data security at risk. Many existing detection techniques fail when the attacker uses intelligent or adaptive jamming strategies that closely resemble normal traffic. To overcome this, we present an intelligent detection approach that combines Fuzzy C-Means (FCM) clustering with data mining. Instead of relying on rigid classification, FCM captures patterns and overlaps in wireless traffic behavior such as changes in noise level, packet loss, throughput, and channel usage making it possible to separate hidden jamming attempts from normal communication. By integrating the adaptability of FCM clustering with the analytical power of data mining, the proposed framework not only enhances the capability to distinguish between normal and malicious wireless traffic under uncertain conditions but also establishes a foundation for developing intelligent, real-time intrusion detection systems that can evolve alongside emerging jamming strategies in future wireless communication environments.

Keywords: Wireless communication, Jamming attack detection, Intelligent jamming, Data mining, Fuzzy C-Means clustering (FCM), Anomaly detection.

AI - DRIVEN OPTIMIZATION OF CLOUD DATA CENTERS: INTELLIGENT WORKLOAD MANAGEMENT, PREDICTIVE MAINTENANCE, ENERGY EFFICIENCY

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Abstract: The exponential growth of data-intensive applications has driven the need for highly scalable, energy- efficient, and resilient cloud infrastructures. This paper investigates the integration of Artificial Intelligence(AI) into modern datacenters and cloud environments ,emphasizing its role in intelligent work load scheduling, predictive maintenance, energy optimization, and security automation. The proposed framework leverages deep reinforcement learning for dynamic resource allocation, achieving up to 25% reduction in latency under fluctuating workloads. Predictive analytics, powered by machine learning regression models, enable early detection of hardware degradation, reducing unplanned downtime by up to 30%. By combining the elasticity of cloud computing with AI-driven intelligence, this approach demonstrates substantial improvements in operational efficiency, sustainability, and fault tolerance, laying the groundwork for the next generation of autonomous, self-optimizing data centers.

Keywords: Artificial Intelligence, Energy efficiency, Machine learning, Data driven application

AI BASED SMART HOME SYSTEM

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Abstract: AI-Based Smart Home Systems represent a transformative fusion of artificial intelligence and the Internet of Things, creating responsive, personalized living environments. Leveraging machine learning, natural language processing, and real-time sensor data, these systems automate and optimize control over lighting, climate, security, and appliances. Key features include voice assistant integration, predictive energy management, and advanced security protocols, all accessible through intuitive interfaces. Benefits span enhanced convenience, improved accessibility for elderly and differently- abled users, and sustainable resource usage. Despite their promise, challenges such as data privacy, device interoperability, and cybersecurity must be addressed to ensure trust and adoption. Looking ahead, deeper personalization and integration with smart city infrastructures signal a future where intelligent homes redefine modern living.

Keywords: Artificial Intelligence (AI), Internet of Things (IoT), Smart Home Automation, Machine Learning, Natural Language Processing (NLP), Predictive Analytics, Voice Assistant Integration, Energy Optimization, Home Security, Accessibility, User Personalization, Smart City Integration.

FEDERATION LEARNING OR PRIVACY PRESERVING AI : ALGORITHM, CHALLENGES AND REAL WORLD APPLICATIONS

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Abstract: Federated learning is a modern AI framework that enables collaborative training of machine learning models across decentralized devices, such as smartphones or institutional servers, without sharing raw data centrally. This privacy-preserving approach allows individuals or organizations to maintain control over their sensitive information, greatly reducing the risk of data exposure or breaches. Critical privacy techniques such as differential privacy, secure multi-party computation, and homomorphic encryption are often used to protect data during model updates and aggregation. However, federated learning introduces specific algorithmic challenges, including handling non-identical data distributions, model and data heterogeneity across clients, potential vulnerability to model poisoning attacks, and increased communication overhead. Real-world applications of federated learning include healthcare (where medical data remains confidential), finance (for secure credit risk evaluation), and IoT systems (like smart devices that cannot risk privacy leaks). These practical deployments highlight federated learning's balance between machine

Keywords: Federated Learning, Decentralized Training, Model Aggregation, Local Data, Client

AI-DRIVEN FRAUD DETECTION AND RISK PREDICTION IN FINTECH

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Abstract: The rapid adoption of digital payment systems has revolutionized the financial sector, but it has also created new vulnerabilities to fraudulent activities and risks. Traditional rule-based methods for fraud detection often fail to keep pace with the dynamic and sophisticated nature of fraudulent schemes. Artificial Intelligence (AI) offers an advanced solution by leveraging machine learning, deep learning, and predictive analytics to detect anomalies, identify suspicious patterns, and mitigate risks in real-time. AI-driven fraud detection systems analyze vast volumes of transaction data, user behavior, and contextual features to distinguish between legitimate and fraudulent activities with high accuracy. Additionally, risk prediction models powered by AI enable financial institutions to proactively assess the probability of fraud, credit default, or transaction failure, thereby enhancing decision-making and security in digital finance.

Keywords: Artificial Intelligence (AI), FinTech, Fraud Detection, Risk Prediction, Digital Transactions, Anomaly Detection, Predictive Analytics, Financial Security, Cybersecurity, Data Mining, Real-time Monitoring, Transaction Analysis, Regulatory Compliance

AI FOR CLIMATE CHANGE: PREDICTIVE MODELING FOR ENVIRONMENTAL SUSTAINABILITY

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Abstract: Artificial Intelligence (AI) is emerging as a key tool in addressing climate change. Through predictive modeling, AI analyzes large and complex environmental datasets to forecast climate patterns, assess risks, and inform sustainability strategies. By integrating data from satellites, sensors, and climate models, AI improves the accuracy of predictions related to extreme weather events, sea level rise, deforestation, and greenhouse gas emissions. These insights help policymakers, researchers, and industries make informed decisions for mitigation and adaptation. In addition to prediction, AI-driven systems optimize the use of renewable energy, enhance disaster response, and support sustainable agriculture and urban planning. Addressing challenges such as data quality, model transparency, and ethical deployment is crucial to maximizing the impact of AI. This paper examines how AI-powered predictive modeling can advance environmental sustainability by providing innovative approaches to address climate change and protect ecosystems for future generations.

Keywords: Artificial Intelligence, Climate Change, Predictive Modeling, Environmental Sustainability, Renewable Energy, Disaster Response, Sustainable Agriculture, Urban Planning

FAKE PROFILE DETECTION ON SOCIAL MEDIA USING DEEP LEARNING

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Abstract: The project “Fake Profile Detection on Social Media using Deep Learning” aims to identify and classify fake or malicious user accounts based on their activity patterns, profile features, and content behavior. Using a deep learning model such as an LSTM or CNN, the system analyzes parameters like username patterns, follower–following ratios, post frequency, and textual content to detect suspicious profiles. This approach enhances social media security by reducing spam, misinformation, and online fraud. Social media platforms are increasingly targeted by fake profiles used for spreading misinformation, scams, and spam content. Social media platforms are increasingly targeted by fake profiles used for spreading misinformation, scams, and spam content. This project proposes a Deep Learning-based Fake Profile Detection System that automatically distinguishes between genuine and fake users. The model utilizes datasets containing both real and fake account information with attributes such as username features, number of followers, posting activity, and textual data.

Keywords: Artificial Intelligence

AI IN EDUCATION : PERSONALIZED LEARNING SYSTEMS FOR THE FUTURE CLASSROOM

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Abstract: The integration of Artificial Intelligence (AI) into education is revolutionizing the traditional classroom by enabling personalized learning systems that adapt to individual student needs, preferences, and progress. This paper explores the transformative potential of AI-driven tools such as intelligent tutoring systems, adaptive learning platforms, and predictive analytics in creating future-ready classrooms. By analyzing student data in real time, these systems can customize content delivery, provide targeted feedback, and support differentiated instruction, thereby enhancing engagement and academic outcomes. The abstract also discusses the ethical considerations, data privacy challenges, and the evolving role of educators in AI-enhanced environments. Ultimately, personalized learning powered by AI promises to democratize education, foster lifelong learning, and prepare students for a rapidly changing digital world.

Keywords: Personalized Learning, Adaptive Learning Systems, Intelligent Tutoring Systems, Learning Analytics, Real-Time Feedback, Future Classroom, Data-Driven Instruction

AI IN HEALTHCARE: TRANSFORMING DIAGNOSIS AND DRUG DISCOVERY

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Abstract: Artificial Intelligence (AI) is revolutionizing the healthcare industry by enhancing diagnostic accuracy, improving treatment planning, and accelerating drug discovery. Through advanced machine learning algorithms and deep neural networks, AI systems can analyze complex medical data, detect patterns invisible to the human eye, and support clinicians in making faster and more reliable decisions. In diagnostics, AI-powered tools are being used to interpret medical images, predict disease progression, and personalize patient care based on individual health profiles. Similarly, in drug discovery, AI streamlines the identification of potential compounds, reduces development costs, and shortens the time required to bring new therapies to market. The integration of AI in healthcare not only optimizes clinical workflows but also enables predictive and preventive care, leading to improved patient outcomes and resource efficiency. This paper explores the transformative role of AI in healthcare, emphasizing its impact on diagnosis, drug development, and the future of precision medicine.

Keywords: Artificial Intelligence (AI), Healthcare, Medical Diagnosis, Machine Learning, Deep Learning, Drug Discovery, Predictive Analytics, Precision Medicine, Clinical Decision Support, Healthcare Innovation

AI/ML FOR HEALTHCARE, MEDICAL IMAGE PROCESSING, REMOTE SENSING

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Abstract: Artificial Intelligence (AI) and Machine Learning (ML) are rapidly revolutionizing healthcare by intensifying the accuracy of medical diagnostics, automating data analysis, and enabling tailored treatment planning across specialties such as radiology, pathology, and oncology. In medical image processing, deep learning algorithms facilitate early disease detection by identifying subtle features in radiographs, MRIs, and histopathology slides, surpassing traditional methods in efficiency and precision. Furthermore, remote sensing—driven by AI—supports real-time patient monitoring and predictive analytics, expanding healthcare reach beyond clinic walls to ambulatory care and telemedicine. Despite the transformative promise, key challenges remain, including data privacy, algorithmic bias, and integration with existing clinical workflows, necessitating robust validation, ethical frameworks, and interdisciplinary collaboration for responsible AI deployment. The comprehensive integration of AI/ML in healthcare stands poised to enhance patient outcomes, streamline clinical operations, and advance the future of precision medicine and remote care delivery.

Keywords: Artificial Intelligence, Machine Learning, Medical Image Processing, Remote Sensing, Healthcare

AI-POWERED INDIGENOUS LANGUAGE PRESERVATION AND LEARNING

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Abstract: The preservation and promotion of indigenous languages have become increasingly critical in the face of globalization and digital transformation. This research explores the potential of artificial intelligence (AI) in revitalizing and sustaining endangered languages. The proposed framework leverages AI technologies such as natural language processing (NLP), speech recognition, and machine translation to digitize and document indigenous languages. By integrating intelligent chatbots and voice recognition systems, the framework facilitates effective communication and learning experiences for users. The system aims to enhance data collection, promote inclusivity, and reduce the risk of language extinction. Furthermore, the research emphasizes the importance of cultural preservation and the role of AI in creating sustainable solutions for language education and revitalization.

Keywords: Artificial Intelligence, Indigenous Languages, Natural Language Processing, Speech Recognition, Machine Translation, Language Preservation, Cultural Revitalization

AI-POWERED CHATBOT

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Abstract: Conversational Artificial Intelligence (AI) has become one of the most transformative technologies, enabling human-like interactions through natural language processing (NLP) and machine learning. This paper presents the design and implementation of an AI-Powered Chatbot capable of understanding user queries, generating intelligent responses, and providing domain-specific assistance. The system integrates deep learning models such as transformer-based architectures to enhance contextual understanding and response accuracy. It supports real-time interaction across multiple platforms, offering personalized user experiences. Furthermore, the chatbot is designed as a scalable solution that can be applied in diverse fields such as education, healthcare, customer support, and smart services. By automating human-computer interaction, the proposed system reduces manual effort, improves response efficiency, and enables 24/7 availability. This research demonstrates how AI-driven conversational systems can serve as intelligent, adaptive, and user-friendly tools for modern applications.

Keywords: Artificial Intelligence, Chatbot, Natural Language Processing, Machine Learning, Conversational AI, Deep Learning

STRESS & BURNOUT DETECTOR USING AI

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Abstract: Stress and burnout are increasingly common in today’s fast-paced lifestyle, often going undetected until they lead to severe physical or mental health issues. Early detection and timely intervention can significantly improve well-being and productivity. This project proposes an AI-powered Stress & Burnout Detector that leverages multimodal data such as voice patterns, typing speed, facial expressions, heart rate (from wearables), and smartphone usage behavior. The system uses machine learning models to identify stress indicators in real time and classify risk levels (low, moderate, high). Based on detection, the application provides personalized micro-interventions including breathing exercises, guided meditation, motivational nudges, or quick relaxation activities. The solution is designed to be non-intrusive, user-friendly, and privacy-focused, ensuring sensitive data is securely processed. By enabling early stress detection and offering instant coping mechanisms, this tool has the potential to reduce burnout, support mental health, and enhance overall quality of life for individuals in both professional and personal environments

Keywords: AI-powered stress detection, burnout monitoring, multimodal data analysis, real-time intervention, mental health support, personalized micro-interventions, privacy-focused, wearable integration

ETHICS, PRIVACY AND RESPONSIBLE AI GOVERNANCE

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Abstract: The widespread and rapid diffusion of artificial intelligence (AI) into all types of organizational activities necessitates the ethical and responsible deployment of these technologies. Various national and international policies, regulations, and guidelines aim to address this issue, and several organizations have developed frameworks detailing the principles of responsible AI. Nevertheless, the understanding of how such principles can be operationalized in designing, executing, monitoring, and evaluating AI applications is limited. The literature is disparate and lacks cohesion, clarity, and, in some cases, depth. Subsequently, this scoping review aims to synthesize and critically reflect on the research on responsible AI. Based on this synthesis, we developed a conceptual framework for responsible AI governance (defined through structural, relational, and procedural practices), its antecedents, and its effects. The framework serves as the foundation for developing an agenda for future research and critically reflects on the notion of responsible AI governance.

Keywords: Artificial intelligence; Responsible AI governance; Governance practices; AI implementation; AI lifecycle

QUANTUM COMPUTING AND ITS IMPACT ON AI & ML

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Abstract: Artificial Intelligence (AI) has been evolving at a very rapid pace, with increase in compute power, thus reshaping how complex problems are handled and interpreted from vast amounts of information. AI and newly emerging Quantum Computing have each made significant strides in recent years. Quantum computing has surfaced as a promising new paradigm that leverages on unique quantum phenomena such as like superposition and entanglement to potentially deliver dramatic gains in computational power. Increasingly, researchers are combining these distinct fields into quantum AI, exploring ways to harness quantum devices for data-intensive tasks, advanced optimisation, and even tentative investigations into emergent machine awareness. Already researchers have established the quantum advantage over classical AI. This paper outlines the fundamental aspects of AI with respect to quantum computing. It also surveys possible benefits for deep learning and optimization, and considers key concerns related to hardware readiness, algorithmic design, and ethical frameworks. By mapping current progress and pinpointing ongoing hurdles, we provide an entry-level guide to quantum AI's prospects and the steps required for its real-world deployment.

Keywords: Quantum Computing, Artificial Intelligence, Hybrid Quantum- Classical Methods, Deep learning, Neural Networks, NISQ

FOG AND EDGE COMPUTING ARCHITECTURES FOR DISTRIBUTED AI SYSTEMS

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Abstract: The rapid growth of the Internet of Things (IoT) and Artificial Intelligence (AI) has accelerated the demand for distributed computing infrastructures that can efficiently manage data processing close to the source. Fog and Edge Computing have emerged as complementary paradigms that extend cloud services to the network edge, enabling low-latency, energy-efficient, and scalable AI-driven applications. This abstract explores the architectures of Fog and Edge Computing in the context of distributed AI systems, focusing on their ability to support real-time analytics, intelligent decision-making, and resource optimization. Key architectural considerations include hierarchical processing layers, interoperability frameworks, security mechanisms, and workload orchestration. The integration of Fog and Edge Computing is essential for addressing challenges such as latency reduction, bandwidth efficiency, and context-aware intelligence in critical domains like autonomous systems, smart cities, healthcare, and industrial automation.

Keywords: Fog Computing, Edge Computing, Distributed AI, Internet of Things (IoT), Low Latency, Smart Cities, Hybrid Architectures

Smart Farming with Explainable AI for Effective Agricultural Decision Making

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Abstract: Agriculture is increasingly challenged by crop diseases, inefficient water and nutrient management, and uncertainties in yield forecasting, all of which compromise productivity and sustainability. This paper presents a comprehensive smart farming framework that integrates Internet of Things (IoT) sensors—including capacitance-based soil moisture probes, DHT22 temperature/humidity sensors, and multispectral imaging cameras—with advanced Artificial Intelligence (AI) and machine learning algorithms for real-time monitoring, predictive analytics, and decision support. Crop disease and pest detection is implemented using Convolutional Neural Networks (CNNs) on RGB and multispectral imagery, achieving classification accuracies above 92%, while Reinforcement Learning (RL) optimizes irrigation schedules based on soil moisture, weather forecasts, and evapotranspiration data, resulting in up to 30% water savings. Nutrient application is guided by Gradient Boosting Machines (GBM) and Random Forest models, predicting NPK requirements with a mean absolute error (MAE) below 5%.

Keywords: AI in Agriculture, Internet of Things, Explainable AI, sensors, Gradient boosting machines, random forest modeling

BIG DATA ANALYTICS : DRIVING AI/ML BREAKTHROUGHS

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Abstract: The rapid growth of data in the digital era has positioned big data analytics as a fundamental enabler of artificial intelligence (AI) and machine learning (ML) advancements. By processing vast, diverse, and complex datasets, big data technologies provide the foundation for training more accurate, scalable, and intelligent models. This paper explores how big data analytics drives breakthroughs in AI/ML through enhanced data preprocessing, real-time analytics, and predictive modeling. It also discusses the role of distributed computing frameworks such as Hadoop and Spark in managing large-scale datasets and facilitating efficient model training. Furthermore, the paper highlights emerging trends—including deep learning, edge analytics, and automated data pipelines—that are reshaping the AI/ML landscape. The synergy between big data and AI/ML not only accelerates innovation across industries but also presents new challenges related to data quality, privacy, and computational efficiency. Addressing these challenges is essential to fully harness the transformative potential of big data-driven intelligence systems.

Keywords: *Big Data Analytics, Artificial Intelligence, Machine Learning, Predictive Modeling, Distributed Computing*

Responsible AI: Ensuring bias Fairness and Ethics in Machine Learning

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Abstract : The rapid advancement of Artificial Intelligence (AI) and Machine Learning (ML) has revolutionized decision-making across sectors such as healthcare, finance, and education. Despite their transformative potential, these technologies raise critical ethical concerns, particularly regarding bias, fairness, transparency, and accountability. When trained on imbalanced or incomplete datasets, machine learning models can inadvertently reinforce existing social inequalities, resulting in discriminatory outcomes. Addressing these challenges necessitates the adoption of Responsible AI practices that prioritize trustworthiness, inclusivity, and human-centered design. This paper explores practical approaches to mitigating bias and promoting fairness in AI through diverse data collection, algorithmic transparency, and ethical governance. It examines real-world cases—including biased recruitment tools, healthcare diagnostic disparities, and unfair credit scoring systems—that illustrate the risks of neglecting ethical principles.

Keywords: *Responsible AI, Machine Learning, Bias, Fairness, Transparency, Ethics, Accountability, Explainable AI (XAI), Ethical Governance, regulatory frameworks, public trust, and social responsibility.*

AMBULANCE TRAFFIC MANAGEMENT SYSTEM

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Abstract: Emergency medical response is critically time-sensitive, with every one-minute delay increasing mortality risk by nearly 10%. In India, this challenge is compounded by urban congestion, rigid traffic signals, and limited coordination between emergency services and traffic systems. Studies show that average ambulance response times vary widely—from 7.3 minutes in Uttar Pradesh, 7.5–8 minutes in Rajasthan, to 15–17 minutes in Delhi and other metros, with rural regions often experiencing longer delays. This work presents a Smart Ambulance Traffic Management System that integrates GPS tracking, AI-based route optimization, and traffic signal preemption to ensure faster and safer ambulance mobility. Leveraging vehicle-to-infrastructure communication, 5G networks, and cloud platforms, the system creates dynamic “green corridors” that prioritize ambulances through congested traffic. Nationwide, NITI Aayog estimates that AI-driven ambulance routing could save 15–20% of lives lost during road accidents annually, underlining the urgent need for scalable adoption of smart traffic management solutions.

Keywords: Emergency Medical Response, Ambulance Response Time.

IMPACT OF ARTIFICIAL INTELLIGENCE IN SOCIETY: OPPORTUNITIES, CHALLENGES, AND FUTURE DIRECTIONS

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Abstract: This study explores the transformative impact of artificial intelligence (AI) on modern society, focusing on its applications across diverse domains such as healthcare, education, business, governance, and daily life. Leveraging advancements in machine learning, natural language processing, and computer vision, AI technologies have enhanced efficiency, decision-making, and accessibility, while simultaneously reshaping social and economic structures. The research highlights both the opportunities and challenges of AI adoption, including improvements in automation, personalized services, and smart decision-support systems, as well as concerns related to ethics, job displacement, data privacy, and bias. By analyzing these dimensions, this study underscores the dual role of AI as both a catalyst for societal progress and a source of critical challenges that require careful government.

Keywords: Artificial Intelligence, Society, Ethical AI, Automation, Governance, Social Impact, Privacy, Responsible AI, Future of Work.

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING FOR PRECISION AGRICULTURE: A SYSTEMATIC REVIEW OF YIELD PREDICTION AND OPTIMIZATION TECHNIQUES

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Abstract: Agriculture is a cornerstone of global food security, yet it faces mounting challenges such as resource scarcity, climate variability, and the increasing demand of a growing population. Artificial Intelligence (AI) and Machine Learning (ML) have emerged as transformative technologies for addressing these challenges by enabling accurate yield prediction, optimizing crop management, and improving overall resource efficiency. This paper presents a Systematic Literature Review (SLR) of 25 key studies that investigate AI-driven yield prediction and optimization techniques. The review identifies widely applied algorithms, including Support Vector Machines (SVM), K-Nearest Neighbors (KNN), Random Forests, Decision Trees, XG Boost, and Neural Networks, as well as deep learning approaches such as Convolutional Neural Networks (CNNs) and Bidirectional Long Short-Term Memory (BLSTM) models. These models leverage soil characteristics, climatic variables, and crop-specific features to achieve yield prediction accuracies of 85–95% in experimental evaluations.

Keywords: *AI & ML for Precision Agriculture Yield Prediction & Optimization*

HYPERAUTOMATION - THE FUTURE

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Abstract: Hyperautomation represents a transformative leap in the evolution of digital automation, combining advanced technologies such as Artificial Intelligence (AI), Machine Learning (ML), Robotic Process Automation (RPA), Process Mining, and Intelligent Business Process Management Systems (iBPMS) to automate complex business operations at scale. As organizations across industries strive for greater efficiency, agility, and resilience, hyperautomation emerges as a strategic imperative rather than a technological option. This paper explores the concept of hyperautomation as a holistic approach to end-to-end process automation, where bots, algorithms, and human intelligence work collaboratively to optimize workflows, reduce operational costs, and enhance decision-making. The convergence of technologies such as Natural Language Processing (NLP), Optical Character Recognition (OCR), low-code/no-code platforms, and digital twins further accelerates automation initiatives, making hyperautomation accessible and scalable across business functions.

Keywords: *Artificial Intelligence, Robotic Process Automation, Business Process Management, Hyperautomation*

IMPACT OF AI ON SOCIETY

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Abstract: Artificial Intelligence (AI) has emerged as a transformative force reshaping modern society across multiple domains, including healthcare, education, business, governance, and everyday life. Its capabilities in automation, data-driven decision-making, and human-machine collaboration have introduced unprecedented opportunities for efficiency, innovation, and economic growth. However, the widespread adoption of AI also raises critical challenges such as ethical concerns, bias in algorithms, job displacement, data privacy risks, and the need for robust regulatory frameworks. This paper explores both the positive contributions and the potential drawbacks of AI in shaping social structures, labor markets, and human interactions. By analyzing case studies, technological advancements, and societal responses, the study highlights the dual role of AI as both an enabler of progress and a driver of disruption. The paper concludes by emphasizing the importance of responsible AI development, interdisciplinary collaboration, and policies that balance innovation with ethical and social considerations, ensuring AI contributes positively to a sustainable and inclusive future.

Keywords: Artificial Intelligence (AI), Automation, Ethical AI, Social Impact, Data Privacy, Human-AI Collaboration, Algorithmic Bias, Digital Transformation, Responsible AI, Future of Work

AI AND DATA SCIENCE IN SMALL BUSINESS

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Abstract: Small businesses are increasingly recognizing the potential of Artificial Intelligence (AI) and Data Science to drive growth, improve efficiency, and gain a competitive edge. This [paper/research] explores the opportunities and challenges of adopting AI and Data Science in small businesses, highlighting the benefits of predictive analytics, machine learning, and data-driven decision-making. Through case studies and expert insights, we examine the practical applications of AI and Data Science in small business, including customer segmentation, marketing automation, and supply chain optimization. Our research provides actionable recommendations for small business owners and managers seeking to harness the power of AI and Data Science to drive innovation and success.

Keywords: Artificial Intelligence, Data Science, Small Business, Innovation, Growth, Efficiency

AI AND THE FUTURE OF WORK

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Abstract: Artificial Intelligence (AI) is emerging as one of the most influential technologies shaping the future of work. By combining advanced automation, data-driven decision-making, and machine learning, AI is transforming industries across the globe. Routine and repetitive tasks are increasingly being handled by AI systems, enabling businesses to achieve higher efficiency and productivity. This shift allows human workers to focus on more creative, analytical, and strategic roles that demand critical thinking and emotional intelligence—areas where humans retain a unique advantage. AI is also creating new opportunities for innovation.

Keywords: Artificial Intelligence, Future of Work, Automation, Workforce Reskilling, Human–AI Collaboration.

NEXT GENERATION COMPUTING - AI

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Abstract: The evolution of computing has reached a transformative juncture, where Artificial Intelligence (AI) is no longer just an application layer but a foundational driver of next-generation computing architectures. As computational demands surge with the rise of big data, autonomous systems, and real-time analytics, AI is redefining how machines process information, make decisions, and interact with others in new environments. This paper delves into the convergence of AI with emerging computing paradigms, including edge computing, neuromorphic hardware, quantum AI, and cloud-based hyper-scale infrastructures. Unlike traditional systems reliant on predefined logic, AI-enabled computing adapts, learns, and evolves, opening the door to dynamic, context-aware solutions. The integration of deep learning accelerators, AI optimized processors, and novel memory architectures is significantly enhancing performance while reducing latency and energy consumption. At the edge, AI is enabling low-power, real-time processing in IoT devices, smart sensors, and autonomous platforms, reducing the dependency on centralized data centers. Meanwhile, quantum computing promises to elevate AI capabilities by exponentially increasing processing power for complex tasks like molecular modeling, cryptography, and multidimensional optimization.

Keywords: Artificial Intelligence ,Natural Language Processing(NLP),Machine Learning

TRUSTWORTHY & EXPLAINABLE AI FOR SOCIETY

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Abstract: Artificial Intelligence (AI) is rapidly influencing society with its ability to enhance efficiency and decision-making. For AI to be widely accepted, it must be trustworthy and explainable. Trust ensures fairness, accountability, and ethical use, while explainability provides clarity in how AI makes decisions. Together, these aspects help build public confidence and promote responsible adoption of AI technologies in society. Artificial Intelligence (AI) has become a transformative force across industries and society, yet concerns about trustworthiness and explainability remain central to its adoption. This paper discusses the importance of creating AI systems that are transparent, fair, accountable, and aligned with human values. It highlights challenges in interpretability, bias reduction, and ethical deployment, while also exploring strategies to make AI more explainable and reliable. The role of regulatory frameworks, technical innovations, and interdisciplinary collaboration is emphasized to ensure that AI serves both industry efficiency and societal well-being in a responsible manner.

Keywords: Trustworthy AI, Explainable AI, Society, Ethics, Accountability.

AI FOR CLIMATE CHANGE: DEEP LEARNING MODELS FOR EXTREME WEATHER PREDICTION

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Abstract: Extreme weather events, including heatwaves, hurricanes, and floods, are increasing in frequency and intensity due to climate change, posing significant risks to human life, infrastructure, and ecosystems. Traditional numerical weather prediction (NWP) models, while widely used, often struggle to capture localized patterns and nonlinear interactions in the climate system, limiting their accuracy for short-term and extreme event forecasting. Recent advances in artificial intelligence (AI) and deep learning offer promising alternatives by automatically learning complex spatio-temporal patterns from large and heterogeneous datasets. This study investigates the application of convolutional neural networks (CNNs) and recurrent neural networks (RNNs), including hybrid CNN-RNN architectures, to predict extreme weather events using a combination of satellite imagery, meteorological station data, and historical climate records. The proposed approach offers scalable, interpretable, and high-performance tools to mitigate the societal impacts of climate change.

Keywords: Climate Change, Deep Learning, Extreme Weather Prediction, CNN, RNN, AI in Meteorology

IMPACT OF ARTIFICIAL INTELLIGENCE ON SOCIETY

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Abstract: Artificial Intelligence (AI) has moved from theoretical possibility to practical reality, profoundly impacting economies, societies, ethical frameworks, and governance worldwide. Its current and near-term effects span the economy, labor markets, healthcare, education, and public sector decision-making, yielding both significant benefits and substantial risks. The following review synthesizes evidence from recent literature and global case studies, providing a comprehensive and multi-dimensional perspective on this technological paradigm shift. AI's scope today extends beyond highly specialized academic projects or technology giants; it is embedded in smartphones, cars, hospitals, businesses, public service systems, and even basic home appliances. Global private AI investment soared to over \$109 billion in 2024, with U.S. companies leading but major activity across China, Europe, and beyond. Multimodal AI models, autonomous agents, and generative algorithms have become mainstream, delivering innovations that touch nearly every aspect of modern life. AI's most profound and measurable impacts are economic. Studies from the IMF and Stanford show that AI-driven productivity gains could increase global GDP by up to 4% over the next decade, with the United States and other advanced economies seeing up to twice the gains of low-income countries due to higher AI preparedness and sectoral exposure.

Keywords: *Artificial Intelligence, multimodal AI models, Autonomous Agents.*

A SURVEY TO DETECT FAKE FACES USING IMAGE VIA DYNAMIC TEXTURE

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Abstract: In this paper, we examine various methods of face identification that determine whether a given face is real or fake. Numerous studies have been conducted to survey these methods, and their advantages and disadvantages are discussed. To undertake this operation several techniques are used to detect fake faces such as based on motion and image quality information. Motion based approaches mainly detects out the natural process of the face such as eye blinking, mouth movement and head rotation. Motion based approaches are simple as it requires multiple number of frames for detecting the given face. Each frame of the original frame of the sequence are gray scaled and pass through a face detector. Only detected faces with more than 50 pixels of width and height were considered. In order to reduce the face detector noise, the same face bounding box was used for each set of frames used in the LBP-TOP calculation.

Keywords- *face identification, face recognition, Spoofing*

ETHICAL AND INCLUSIVE RECRUITMENT SYSTEM USING GENERATIVE AI

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Abstract: Generative Artificial Intelligence (GenAI) is revolutionizing how organizations evaluate and recruit talent by automating complex, multi-stage hiring processes. This study presents an Ethical and Inclusive Recruitment System Using GenAI that ensures unbiased, transparent, and skill-based candidate selection. The system is adaptable, supporting 4 to 10 interview rounds—including aptitude, technical, communication, situational judgment, and HR rounds—depending on company requirements. It also performs certificate authenticity verification using AI-driven document validation models. By leveraging GenAI for resume parsing, dynamic question generation, and personalized candidate assessment, the system provides fair evaluations across diverse candidate profiles. Explainable AI (XAI) components enhance transparency by clarifying how each decision is made. This approach not only improves hiring efficiency and fairness but also supports inclusivity by minimizing human bias and enhancing trust in AI-driven recruitment ecosystems.

Keywords: *Generative AI, Ethical Recruitment, Inclusive Hiring, Certificate Verification, Explainable AI, Automated Candidate Evaluation, Natural Language Processing, Fairness in AI, Human Resource Analytics, Artificial Intelligence in Recruitment.*

PERSONALIZED MARKETING WITH MACHINE LEARNING IN SMALL RETAIL BUSINESSES

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Abstract: In an increasingly competitive retail landscape, small businesses must leverage innovative technologies to maintain customer engagement and loyalty. This study explores the application of machine learning (ML) techniques in enabling personalized marketing strategies for small retail enterprises, particularly in e-commerce and brick-and-click settings. By analyzing customer data such as browsing history, purchase patterns, and demographic information, ML algorithms—especially recommendation systems—can deliver tailored product suggestions and targeted promotions that enhance user experience and drive sales. The research includes a case study using open-source retail datasets to simulate a personalized recommendation engine with collaborative filtering and content-based techniques. Findings highlight both the performance and practicality of deploying lightweight, scalable ML models using accessible tools like Python, Google Colab, and cloud-based APIs. Additionally, the paper discusses implementation challenges such as data sparsity, privacy concerns, and resource constraints common to small firms.

Keywords: *Machine learning, Recommendation engine, data sparsity.*

NEXT GENERATION COMPUTING –AI

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Abstract: Next-generation computing AI represents a transformative leap in how machines process information, learn, and interact with the world. Unlike traditional AI systems that rely on structured data and predefined rules, next-gen AI is characterized by its ability to learn autonomously, adapt in real time, and reason more like humans. This evolution is driven by breakthroughs in areas like neuromorphic computing, quantum AI, edge intelligence, and large-scale generative models. Neuromorphic computing mimics the human brain’s neural architecture, offering ultra-efficient pattern recognition and decision-making capabilities. Quantum computing, though still in early stages, promises exponential increases in processing power, allowing AI to solve problems that are currently intractable—such as complex simulations for drug discovery or climate modeling. Meanwhile, edge AI brings intelligence closer to the data source, enabling faster, privacy-preserving decision-making in devices like smartphones, drones, or autonomous vehicles. At the core of next-gen AI is the fusion of massive data processing with context-aware learning, leading to systems that can understand, generate, and improve without constant human input.

Keywords: Quantum Computing, large language models, computing, climate modelling.

LEVERAGING ARTIFICIAL INTELLIGENCE AND DATA SCIENCE FOR SMALL BUSINESS GROWTH: OPPORTUNITIES, CHALLENGES AND SOLUTIONS

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Abstract: Artificial Intelligence (AI) and Data Science (DS) have transformed the operational landscape of modern enterprises. While large corporations have long benefited from these technologies, small businesses are now emerging as critical beneficiaries of AI-driven solutions due to the increasing availability of cloud-based platforms, affordable tools, and low-code frameworks. This paper explores the role of AI and DS in enabling small businesses to achieve competitive advantage, operational efficiency, and customer-centric innovation. Through a comprehensive review of literature, methodology, and case studies, the paper identifies practical applications across customer service, marketing, finance, inventory, and human resource management. It also highlights the barriers to adoption, such as cost constraints, limited expertise, and ethical concerns, while providing recommendations for fostering AI-enabled small business ecosystems. The findings underscore the transformative potential of AI and DS in ensuring the resilience, growth, and sustainability of small businesses in an increasingly digital economy.

Keywords: Artificial Intelligence (AI), Data Science (DS), Small Businesses, Machine Learning (ML), Predictive Analytics, Digital Transformation, Business Intelligence.

AI-POWERED STUDENT LEARNING COMPANION: A CONSISTENCY, DECISION-MAKING, AND SELF-RELIANCE FRAMEWORK

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Abstract: Students in the 21st century face multiple challenges in learning such as irregular study habits, poor decision-making skills, and over-reliance on Artificial Intelligence (AI) tools for direct answers. While existing educational platforms focus on delivering information, they often fail to develop self-discipline and independent thinking. This paper proposes an AI-powered Student Learning Companion, designed to support students through four major functions: a revision and consistency coach, a decision-making guide, a balanced problem-solving assistant, and a reflection journal with personalized feedback. The system is built on transformer-based Natural Language Processing (NLP) models, gamification techniques, and data-driven performance tracking. Unlike existing tools that provide instant answers, this framework emphasizes guidance over spoon-feeding, encouraging critical thinking and self-reliance. The proposed system has the potential to transform education by making AI a mentor rather than a shortcut, thereby enhancing consistency, decision-making, and independent learning for students across schools, colleges, and competitive exams.

Keywords: AI in education, student learning, self-reliance, consistency, decision-making, gamification, Natural Language Processing.

AI-DRIVEN FRAMEWORK FOR AUTOMATED QUESTION PAPER GENERATION

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Abstract: An intelligent web-based Question Paper Generator designed to enhance academic assessment efficiency. The system allows educators to upload study materials and supplementary resources, which can be tagged and organized for streamlined management. Using advanced natural language processing techniques, it automatically generates short-answer, long-answer, and multiple-choice questions with difficulty calibrated according to Bloom’s Taxonomy. Multi-threading enables background processing of resource-intensive tasks, maintaining a responsive user experience. Implemented with Django and NLP-based question generation models, this platform significantly reduces faculty workload, provides contextually relevant assessments, and bridges the gap between learning content and evaluation, offering a scalable solution for modern educational institutions.

Keywords: Bio-Fertilizer, Panchgavya, Organic Farming, Automated Stirring, Mechanized Solution

AI-DRIVEN MULTI-STRATEGY ALGORITHMIC TRADING AND PORTFOLIO MANAGEMENT SYSTEM

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Abstract: In recent years, algorithmic trading has evolved as a crucial component of fintech, with machine learning and AI increasingly being integrated to extend traditional strategies. Existing research focuses either on optimizing a single strategy (e.g., Kalman filters, PPO reinforcement learning, or CNNs) or on improving forecasting accuracy. However, these models lack adaptability, explainability, and multistrategy integration. In this paper, we propose an AI-powered multi-strategy trading system that dynamically selects between machine learning (ML), reinforcement learning (RL), genetic algorithms (GA), and technical analysis (TA)- based strategies based on real-time win-rate evaluation. The system includes a dashboard for visualization, portfolio analytics, risk metrics (VaR, Sharpe Ratio, CVaR), and voice-interactive control for practical use by traders.

Keywords: Algorithmic Trading, Reinforcement Learning, Genetic Algorithms, Explainable AI, Portfolio Management, Sentiment

NEXT-GEN PROGRAMMING EDUCATION USING AI GENERATED ANIMATED LESSONS

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Abstract: This project introduces an AI-powered Teaching Platform for Programming Languages that integrates intelligent tutoring, guided animations, and online assessments using Large Language Models (LLMs). The system provides real-time code explanations and interactive assistance, enabling learners to understand complex programming concepts more effectively. It features an AI-driven syntax search engine that helps users explore programming queries, identify syntax patterns, and automatically resolve coding errors. It integrates testing, teaching, and evaluation within a single intelligent framework. This eliminates the dependency on multiple tools and scattered online resources. By merging automation with pedagogy, the system reduces instructor workload while maintaining effectiveness. Learners gain confidence by solving realworld coding challenges with AI-assisted guidance.

Keywords: Bio-Fertilizer, Panchgavya, Organic Farming, Automated Stirring, Mechanized Solution

SMART CAMPUS CONNECT: REAL-TIME ATTENDANCE & STAFF LOCATION MANAGEMENT SYSTEM

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Abstract: This paper presents a smart attendance and staff location management system tailored for educational campuses, integrating advanced face recognition, geofencing, and Wi-Fi/IP validation to ensure secure and accurate presence marking. The system is designed to automate attendance recording by verifying identity biometrically while simultaneously confirming physical location within defined campus zones, reducing potential fraud such as proxy attendance. A mobile application enables seamless attendance capture through face recognition, while geofencing uses GPS-based virtual boundaries and Wi-Fi/IP address checks to validate users' campus presence in real time. Experimental deployment in a university environment demonstrated over 98% accuracy in face recognition, minimal latency with average check-ins under three seconds, and positive user acceptance regarding usability and reliability. The system's modular architecture supports scalability and may be adapted to varying institutional sizes and policies.

Keywords: Smart campus, face recognition, geofencing, attendance system, staff management, realtime monitoring, intelligent

ADAPTIC DIDACTIC INFRASTRUCTURE FOR NOVICE LEARNERS WITH PEDAGOGY USING AI

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Abstract: Artificial Intelligence (AI) has emerged as a transformative force in education, offering adaptive and personalized learning experiences that extend beyond conventional instructional models. Traditional pedagogical methods often lack interactivity, adaptability, and inclusivity, limiting holistic development among novice learners. This paper proposes an Adaptive Didactic Infrastructure (ADI) powered by AI that integrates academic learning with life skill development through interactive games, adaptive assessments, and multimodal content delivery. Unlike existing tutoring systems, the ADI emphasizes deeper conceptual comprehension, critical thinking, and creativity by leveraging natural language understanding and AI-driven visualization tools. The framework ensures equitable learning opportunities through personalized progress tracking, real-time feedback, and dynamic adjustment of instructional strategies. This study highlights the methodological design, experimental results, and potential applications of the ADI framework as a scalable, inclusive, and future-ready educational paradigm.

Keywords: Artificial Intelligence, Adaptive Learning, Pedagogy, Intelligent Tutoring, Personalized Education, Reinforcement Learning, Gamification

ANALYSIS AND CLASSIFICATION USING MACHINE LEARNING ALGORITHMS FOR EARLYSTAGE PREDICTION OF ALZHEIMER'S DISEASE

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Abstract: Progressive cognitive decline and complex pathological alterations are the defining characteristics of Alzheimer's Disease (AD), a debilitating neurodegenerative disorder. Although early-stage prediction remains a major challenge, it is crucial for timely intervention and improved patient outcomes. This study introduces a novel, integrated machine learning and deep learning framework for early-stage prediction of AD through multimodal data integration that encompasses neuroimaging, genetic biomarkers, clinical records, and wearable sensor data. The proposed system combines hierarchical graph neural networks (HGNNs) and adaptive temporal convolutional networks (ATCNs) to effectively model both spatial and temporal dependencies within heterogeneous longitudinal datasets. An attention-weighted meta- classifier, along with dynamic patient-specific feature selection and advanced data preprocessing techniques, enhances predictive precision and robustness.

Keywords: *Alzheimer's Disease, Early-Stage Prediction, Machine Learning, Deep Learning, Neuroimaging, Genetic Biomarkers, Blockchain Technology, HGNNs, ATCNs*

AUTOMATED EXTRACTION OF STRUCTURED DATA FROM IDENTITY DOCUMENTS FOR FINANCIAL SERVICES

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Abstract: The processing of identity documents, such as driver's licenses and passports, is a critical yet time- consuming task in many industries, particularly in financial services like mortgage applications. Manual data entry is prone to errors and inefficiencies. This paper presents a system for the automated extraction of key information from scanned images of driver's licenses and passports. The proposed methodology involves a pipeline comprising image pre-processing, text detection using Optical Character Recognition (OCR), and a rule-based parsing algorithm to locate and structure specific data fields. The target fields for licenses include the issuing state, full name, address, and license number, while for passports, they include the document number, name, nationality, and date of birth. The system is designed to integrate with the workflow of financial service providers, like Mortgage Central, to streamline customer on boarding and verification processes. Initial results on a sample dataset demonstrate the feasibility of the approach, accurately extracting the majority of required fields. The implementation highlights the potential for significant reductions in processing time and human error, thereby enhancing operational efficiency and customer experience.

Keywords—*document automation, information extraction, optical character recognition (OCR), financial technology, identity verification, data parsing*

AI-BASED COMPLIANCE ASSISTANCE USING LLM’S FOR STARTUPS

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Abstract: Regulatory compliance poses a significant challenge for startups due to the rapidly evolving nature of legal frameworks and the lack of dedicated compliance teams. This paper presents LexiComply, an AI-powered compliance assistant designed to automate and streamline the process of regulatory understanding, monitoring, and adherence for startups. The proposed system employs a multi-stage architecture that begins with the ingestion and preprocessing of unstructured legal and policy documents in diverse formats such as PDF, DOCX, and HTML. These documents are parsed using a custom Natural Language Processing (NLP) pipeline that performs entity recognition, contextual sectioning, and semantic similarity clustering to extract actionable compliance information. A fine-tuned Large Language Model (LLM) serves as the reasoning engine, capable of understanding complex regulatory clauses and providing precise, context-aware compliance insights in natural language. Additionally, a rule-based verification layer cross-references LLM outputs with authoritative datasets to ensure factual accuracy and legal validity. The system integrates an interactive web dashboard where users can upload documents, pose regulatory queries, and receive real-time guidance.

Keywords: *Regulatory Compliance, Large Language Models (LLM), Natural Language Processing (NLP), Legal Document Analysis, Automation, Startups, Rule-based Verification, Information Retrieval!*

AN AI POWERED MOBILE APPLICATION DETECTION AND MONITORING -SMART WOUND USING ML

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Abstract: Wound care management is a critical aspect of healthcare, requiring timely detection, assessment, and monitoring to prevent complications such as infections and delayed healing. Smart Wound is an innovative mobile application designed to leverage artificial intelligence (AI) and image processing technologies to detect and analyze wounds using smart phone cameras. The app employs deep learning models to classify wound types, assess severity, and provide real-time recommendations for treatment. Additionally, it integrates a user-friendly interface for patients and healthcare providers to track wound progression over time through automated documentation and reminders. By enhancing accessibility to wound assessment and reducing the burden on healthcare professionals, Smart Wound aims to improve patient outcomes and streamline wound care management.

Keywords: *Smart Wound, Leverage artificial intelligence, Healthcare professionals.*

IMPACT OF ARTIFICIAL INTELLIGENCE ON SOCIETY

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Abstract: Artificial Intelligence (AI) has moved from theoretical possibility to practical reality, profoundly impacting economies, societies, ethical frameworks, and governance worldwide. Its current and near-term effects span the economy, labor markets, healthcare, education, and public sector decision-making, yielding both significant benefits and substantial risks. The following review synthesizes evidence from recent literature and global case studies, providing a comprehensive and multi-dimensional perspective on this technological paradigm shift. AI’s scope today extends beyond highly specialized academic projects or technology giants; it is embedded in smartphones, cars, hospitals, businesses, public service systems, and even basic home appliances. Global private AI investment soared to over \$109 billion in 2024, with U.S. companies leading but major activity across China, Europe, and beyond. Multimodal AI models, autonomous agents, and generative algorithms have become mainstream, delivering innovations that touch nearly every aspect of modern life AI’s most profound and measurable impacts are economic. Studies from the IMF and Stanford show that AI-driven productivity gains could increase global GDP by up to 4% over the next decade, with the United States and other advanced economies seeing up to twice the gains of low-income countries due to higher AI preparedness and sectoral exposure.

Keywords: *Artificial Intelligence, multimodal AI models, Autonomous Agents.*

MULTIMODAL GENERATIVE AI FOR PERSONALIZED LEARNING IN EDUCATION

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Abstract:This paper presents a multimodal generative AI framework designed to deliver personalized learning experiences in higher education. By combining large language models (LLMs), diffusion-based image generation, and adaptive video synthesis, the framework produces customized learning materials that align with individual learner profiles. The system dynamically tailors instructional content, visual aids, and interactive quizzes based on learner feedback and performance data. Experimental evaluation demonstrates that multimodal generative systems improve engagement and retention by 25% compared to conventional e-learning methods. Ethical and pedagogical implications, including bias control, data privacy, and AI-human collaboration, are also discussed. This research highlights the potential of generative AI to transform higher education into a more inclusive and adaptive learning environment.

Keywords: *Generative AI, Multimodal Learning, Personalized Education, Large Language Models, Educational Technology*

OPTIMIZED RESOURCE ALLOCATION FOR HOMELESS SHELTER MANAGEMENT

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Abstract: ShelterConnect is a real-time shelter matching system designed for people experiencing homelessness in urban India. It integrates GPS-based geofencing (Leaflet maps), real-time bed capacity dashboards, and mobile-first low-bandwidth interfaces to help users locate nearby shelters, meals, and services without requiring login or ID. The platform ensures anonymity, dignity, and accessibility, with results filtered by walkable distance (1–5 km) and regional language/voice support. Shelter availability is updated in real time by NGOs or municipal staff through simple dashboards or WhatsApp commands, while the admin panel enables emergency alerts, capacity management, and utilization heatmaps. Pilot deployment in Delhi and Mumbai demonstrated 95% location accuracy, reservations under 20 seconds, and strong acceptance among low-literacy populations. Its modular, open- source design supports scalability to other Indian cities, integration with government welfare schemes, and future expansion into services like health check-ups, hygiene kits, and food distribution—transforming shelter access from uncertainty to assurance, and from charity to dignity.

Keywords:- Homeless shelter, real-time availability, geofencing, Leaflet map, India, low-bandwidth, social safety net, NGO dashboard, mobile-first, accessibility.

SAFESPACE: AN AI-ENABLED WOMEN’S SAFETY MOBILE APPLICATION WITH SOS ALERTS, OFFLINE GPS TRACKING, AND CONTEXT-AWARE AUDIO RECORDING

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Abstract: Women’s safety remains a critical concern worldwide, where timely assistance and reliable evidence can make a life-saving difference during emergencies. Conventional safety measures, such as manual phone calls or location sharing, are often slow, require internet connectivity, and depend heavily on the victim’s ability to act under stress. To overcome these limitations, this project proposes SafeSpace, an AI-enabled women’s safety mobile application that combines SOS alerts, offline GPS tracking, and context-aware audio recording into a single, easy-to-use platform. Unlike conventional safety apps, SafeSpace emphasizes lightweight design for low battery consumption, offline support, and AI-driven context awareness, making it both practical and intelligent. By offering instant connectivity, reliable offline safety measures, and AI- powered decision support, SafeSpace contributes to creating safer environments and empowering women with technology-driven personal security.

Keywords: Women’s Safety, Mobile Application, Artificial Intelligence (AI), Voice Recognition, SOS Alert, GPS Tracking, Offline Communication

ENHANCING PERSON RE-IDENTIFICATION FOR ROBUST SURVEILLANCE SYSTEM

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Abstract: Person re-identification (Re-ID) is a critical challenge in computer vision, aiming to match individuals across non-overlapping camera views under varying conditions of appearance, lighting, and pose. This project leverages Deep Neural Networks (DNNs) and 2D Convolutional Neural Networks (CNNs) to perform robust feature extraction, enabling precise alignment and matching of individuals across frames. Local Binary Patterns (LBP) and Histogram of Oriented Gradients (HOG) are employed for efficient feature extraction and person detection during the pre-processing pipeline. A scalable, real-time web application built with Flask and Streamlit facilitates intuitive person re-identification from video inputs, ensuring practical deployment in surveillance, security, and forensic systems. To develop a real-time person re-identification system with a user-friendly web interface using Flask and Streamlit for efficient deployment in smart surveillance applications.

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ARTIFICIAL INTELLIGENCE IN HEALTHCARE AND MEDICINE: CLINICAL APPLICATIONS, THERAPEUTIC ADVANCES, AND FUTURE PERSPECTIVE.

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Abstract: Artificial intelligence (AI) has emerged as a transformative force in healthcare and medicine, offering innovative solutions to pressing challenges such as rising costs, workforce shortages, limited access to care, and disparities across populations. By integrating machine learning, deep learning, and data-driven strategies, AI is being applied in diverse areas including medical imaging, diagnostics, predictive analytics, telemedicine, personalized medicine, and drug discovery. These applications enable early disease detection, improved clinical decision-making, treatment planning, and resource optimization, while also supporting patient monitoring and expanding access to care in both advanced and resource-limited settings. Beyond improving efficiency and outcomes, AI holds potential for promoting equity in healthcare through scalable and cost-effective interventions. Nevertheless, successful deployment requires addressing significant barriers such as data privacy, algorithmic bias, lack of interpretability, regulatory oversight, and maintaining clinical trust.

Keywords: Artificial intelligence, Healthcare systems, Diagnostics

DESIGN AND DEVELOPMENT OF A LOW-COST PORTABLE ECG MONITORING SYSTEM

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Abstract: Cardiovascular diseases remain a leading cause of mortality worldwide, emphasizing the need for affordable and accessible diagnostic tools. Conventional electrocardiogram (ECG) systems are often bulky, expensive, and restricted to clinical environments, limiting their utility for continuous monitoring and early detection of abnormalities. This paper presents the design and development of a low-cost, portable ECG monitoring system aimed at bridging the gap between clinical accuracy and patient accessibility. Signal processing algorithms are employed to filter baseline wander, powerline interference, and motion artifacts, ensuring high-quality ECG waveform reconstruction. The device is powered by a rechargeable battery, making it lightweight and suitable for continuous, ambulatory monitoring. Preliminary testing demonstrates that the system achieves reliable detection of key ECG features such as P-waves, QRS complexes, and T-waves, with accuracy comparable to standard clinical devices.

*Keywords—*Portable ECG, Low-Cost Biomedical Device, Remote Health Monitoring, Wearable Sensors, Telemedicine

AI FOR PUBLIC HEALTH & WELLBEING

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Abstract: Artificial Intelligence (AI) is changing public health and wellbeing by allowing more intelligent, quicker, and more effective healthcare solutions. AI technologies, such as machine learning, natural language processing, and predictive analytics, are being used more and more to monitor, prevent, and manage health conditions at the individual and community levels. In healthcare, AI supports early detection of disease, forecasting of outbreaks, and tailored health interventions through the analysis of large volumes of data from hospitals, clinics, and public databases. In addition, AI-based tools aid mental health by detecting early warning signs of depression, stress, or anxiety based on behavior and language patterns. Along with its potential, limitations like data privacy, bias in algorithms, and compatibility with healthcare systems in place need to be resolved in order to make it equitable and effective. As a whole, AI provides a revolutionary way to augment public health infrastructure and encourage overall wellbeing by closing gaps between data-driven information and practical health interventions.

Keywords: Artificial Intelligence, Public Health, Wellbeing, Predictive Analytics, Machine Learning, Disease Surveillance, Preventive Healthcare, Wearable Health Devices, Mental Health, Health Informatics, Digital Health, Health Policy.

ARTIFICIAL INTELLIGENCE IN BIOMEDICAL

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Abstract: Artificial Intelligence (AI) has rapidly emerged as a transformative force in biomedical sciences, significantly enhancing healthcare diagnosis, treatment, monitoring, and biomedical research. Through advanced algorithms such as Machine Learning (ML) and Deep Learning (DL), AI improves medical imaging diagnostic accuracy, genomics data analysis, and drug discovery processes. For instance, deep learning models have achieved diagnostic accuracy above 97%, outperforming traditional methods, while AI-driven genomic data mining has improved mutation detection rates by 18%, aiding precision medicine. Reinforcement learning has accelerated compound screening in drug development, reducing both time and cost. AI's integration in biomedical applications spans diverse disciplines including microbiology, pathology, clinical chemistry, and hematology—supporting tasks from pathogen identification and cancer diagnosis to clinical decision support. Despite these advances, challenges remain regarding model complexity, data privacy, regulatory compliance, and AI explainability. This abstract underscores AI's crucial role in advancing biomedical discoveries, precision medicine, and improving healthcare outcomes.

Keywords: Artificial Intelligence, Biomedical Sciences, Machine Learning, Deep Learning, Medical Imaging, Genomics, Precision Medicine, Drug Discovery, Clinical Decision Support, Explainable AI

NEUROMORPHIC COMPUTING IN HEALTHCARE: A PATH TOWARDS INTELLIGENT AND ENERGY-EFFICIENT MEDICAL SYSTEMS

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Abstract: The rapid evolution of Artificial Intelligence (AI) has transformed healthcare through advanced data analysis, pattern recognition, and decision support. **Neuromorphic computing**, inspired by the structure and functionality of the human brain, offers a promising solution by enabling real-time, low-power, and highly adaptive processing for complex healthcare applications. This paper explores the potential of neuromorphic systems in healthcare, focusing on disease diagnosis, brain-computer interfaces, personalized medicine, and rehabilitation technologies. Neuromorphic chips and **Spiking Neural Networks (SNNs)** provide advantages such as energy-efficient computation, improved fault tolerance, and the ability to handle noisy medical data. The study also highlights current challenges, including hardware limitations, lack of standardized algorithms, and ethical concerns regarding patient data. Nevertheless, with ongoing advancements in semiconductor design, materials science, and AI algorithms, neuromorphic computing is poised to revolutionize the next generation of intelligent, energy-efficient healthcare systems.

Keywords: Neuromorphic Computing, Spiking Neural Networks, Biomedical Engineering, AI in Healthcare, Precision Medicine

ADVANCES IN 3D PRINTING OF BIOMATERIALS FOR TISSUE ENGINEERING APPLICATIONS

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Abstract: Recent advances in three-dimensional (3D) printing have revolutionized the field of tissue engineering by enabling the fabrication of patient-specific, biomimetic scaffolds that closely replicate native tissue architecture. This paper reviews the progress in biomaterials, printing techniques, and bioink development that support functional tissue regeneration. Emerging hybrid composites and decellularized extracellular matrix (dECM)-based bioinks further enhance cellular adhesion and differentiation. Printing technologies including extrusion, inkjet, stereolithography, and laser-assisted methods have achieved higher precision, multi-material integration, and real-time crosslinking—enabling the creation of complex vascularized constructs. Simulation and in vitro studies demonstrate significant improvements in osteogenic, chondrogenic, and cardiomyogenic outcomes, underscoring the clinical potential of these approaches. Despite challenges in large-scale production, long-term stability, and regulatory approval, ongoing innovations such as 4D bioprinting, IoT-enabled bioreactors, and AI-based design optimization are paving the way toward personalized regenerative therapies.

Keywords: 3D Printing, Biomaterials, Tissue Engineering, Regenerative Medicine

AI INTEGRATED BIO-SKIN FOR PREDICTING EARLY ORGAN FAILURE

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Abstract: Organ failure such as kidney, liver, and heart failure often progresses silently, becoming detectable only after significant damage has occurred. This project proposes the development of an **AI-integrated bio-skin patch** capable of real-time monitoring of key biochemical and physiological parameters to predict early signs of organ failure. The bio-skin consists of a flexible, wearable patch embedded with micro-sensors that measure biochemical markers such as electrolytes (K⁺, Na⁺), creatinine, lactate, and bilirubin, along with vital signs including heart rate, oxygen saturation, and skin temperature. This system offers a **non-invasive, continuous, and predictive monitoring solution** for individuals at high risk of organ dysfunction. Beyond hospital settings, it can be utilized for home monitoring of chronic patients and in rural or resource-limited environments. Expected outcomes include a functional prototype concept and predictive AI simulations, demonstrating the feasibility of this next-generation biomedical device aimed at preventing severe health conditions through early intervention.

Keywords: Prediction of Organ Failure, Biodegradable Patch, AI-Based Monitoring, Biomedical Sensors, Early Diagnosis

MEDICAL ROBOTICS: REVOLUTIONIZING SURGERY AND PATIENT CARE

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Abstract: Medical robotics has emerged as a transformative technology in healthcare, particularly within surgical applications where precision, safety, and efficiency are critical. Robotic-assisted systems augment the skills of surgeons by enhancing dexterity, stability, and visualization-enabling minimally invasive procedures that reduce complications and shorten recovery time. These systems integrate advanced sensors, real-time feedback, and AI-driven algorithms to improve accuracy and responsiveness in complex medical environments. This paper reviews the current applications, advantages, limitations, and future prospects of medical robotics, emphasizing its immense potential to revolutionize surgical precision, enhance patient outcomes, and redefine the future of healthcare.

Keywords: Medical Robotics, Robotic-Assisted Surgery, Patient Care, Biomedical Engineering, Rehabilitation Robots, Tele-Surgery, Artificial Intelligence in Healthcare

ROBOTICS-ENABLED TARGETED DRUG DELIVERY FOR PRECISION THERAPEUTICS

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Abstract: Targeted drug delivery has become a key focus in modern biomedical engineering as clinicians strive to maximize therapeutic benefits while minimizing systemic side effects. Conventional administration methods such as oral intake and intravenous infusion often expose healthy tissues to high drug concentrations and rely on passive diffusion for distribution. The system employs biocompatible micro-robots guided by external electromagnetic fields to traverse microfluidic channels and the human circulatory system. Embedded pH and temperature sensors, along with biomarker-responsive chemical detectors, continuously monitor the environment, while a real-time control algorithm adapts the robots' trajectory and regulates dosage for on-demand release when optimal physiological conditions are detected. This study underscores the potential of robotics to bridge engineering and medicine, creating a minimally invasive, patient-specific drug delivery system. By combining precise mechanical control with intelligent sensing and adaptive algorithms, robotic micro-systems offer a scalable pathway toward next-generation precision therapeutics and personalized healthcare.

Keywords: Targeted Drug Delivery, Micro-Robots, Precision Medicine, Biosensors, Adaptive Control, Biomedical Engineering

BIODEGRADABLE HYDROGEL PATCHES WITH NATURAL EXTRACTS FOR DRUG DELIVERY AND ENHANCED WOUND HEALING

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Abstract: A wound is defined as a break or damage to living tissue such as skin, mucous membranes, or organs, resulting from injuries, surgery, accidents, or underlying health conditions. Wound management remains a major challenge in healthcare, particularly for chronic wounds, acute injuries, burns, and post-surgical recovery. Previous studies on hydrogel-based wound dressings have demonstrated significant potential in maintaining moisture balance and enabling drug delivery. This study introduces a biodegradable hydrogel patch composed of natural and synthetic polymers, incorporating plant-based extracts with proven antimicrobial, anti-inflammatory, and tissue-regenerative properties. The biodegradable nature of the patch eliminates the need for removal after healing, reducing patient discomfort and environmental burden. Designed for continuous drug release, improved mechanical stability, and enhanced biocompatibility, the proposed hydrogel patch addresses previous shortcomings while offering a cost-effective, eco-friendly, and patient-centered solution.

Keywords: Biodegradable Hydrogel, Natural Extracts, Drug Delivery, Wound Healing, Antimicrobial

THE HUMAN OPERATING SYSTEM IN MENTAL HEALTH

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Abstract: The concept of a Human Operating System (HOS) provides a powerful framework for understanding mental health through the lens of how humans process, regulate, and respond to internal and external information. In this analogy, thoughts can be seen as data, emotions as signals, and behaviours as outputs. When the HOS functions optimally, individuals demonstrate clarity, adaptability, and effective coping strategies. Understanding mental health as an operating system highlights the importance of regular "updates" through learning, self-reflection, and therapy, as well as "debugging" harmful cognitive patterns. This approach encourages a holistic perspective that integrates neuroscience, psychology, and behavioural science, offering practical tools for prevention and intervention. By viewing mental health as the management of a complex human operating system, individuals and professionals can work toward optimizing mental performance, strengthening resilience, and promoting overall psychological well-being.

Keywords: Human Operating System (HOS), Mental health, Cognitive processes, Emotional regulation, Resilience, Psychological well-being, System errors, Negative thinking patterns, Adaptive coping, Neuroscience, Behavioral science, Self-reflection, Therapy, Holistic approach, Mental performance

WRIST WISE WELLNESS: WEARABLE’S FOR RAPID RHYTHM RESCUE

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Abstract: This paper presents the design and development of a smartwatch-based cardiac monitoring system using a photoplethysmography (PPG) sensor for early detection of arrhythmia and heart failure. The device continuously captures pulse waveform data and applies advanced signal processing algorithms to identify arrhythmic events such as atrial fibrillation. Heart failure detection is further enhanced through analysis of heart rate variability and PPG-derived hemodynamic parameters, enabling identification of abnormal cardiovascular conditions. Real-world validation demonstrates high sensitivity and specificity in arrhythmia detection. The proposed system offers a non-invasive, accessible, and real-time monitoring solution, significantly improving outcomes for individuals at risk of cardiac events.

Keywords: Arrhythmia detection, photoplethysmography, smartwatch, heart failure, wearable medical devices

MIND TO MOTION – NEXT-GEN REHAB ROBOTICS

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Abstract:Neurological disorders such as stroke and paralysis often result in severe motor impairments, requiring prolonged and intensive rehabilitation. Conventional therapies, while effective, depend heavily on therapist involvement and lack active patient engagement. This paper introduces “Mind to Motion – Next-Gen Rehab Robotics”, a Brain–Computer Interface (BCI)-driven system that enables patients to control robotic assistive devices using thought alone. The system utilizes non-invasive EEG signal acquisition to capture motor imagery patterns when patients imagine movement. These signals are processed to remove noise, extract features such as α and β rhythms, and classified using machine learning algorithms. The decoded intentions are then mapped to rehabilitation robots—such as robotic gloves, exoskeletons, or assistive arms—facilitating movements like grasping or lifting. Simulation and prototype trials demonstrate enhanced motor rehabilitation, increased patient independence, and improved engagement.

Keywords: Brain–Computer Interface, rehabilitation robotics, EEG, neuroplasticity, stroke recovery

AI-INTEGRATED BLOCKCHAIN FRAMEWORK FOR SECURE AND INTELLIGENT HOSPITAL ASSET MANAGEMENT

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Abstract: The rapid expansion of healthcare infrastructure has intensified the demand for secure, transparent, and intelligent asset management systems in hospitals. Traditional asset management methods often suffer from data silos, lack of real-time visibility, and susceptibility to unauthorized access. This paper proposes an AI-Integrated Blockchain Framework designed to enhance hospital asset management by combining the immutability and transparency of blockchain with the predictive power of artificial intelligence. Blockchain ensures tamper-proof records of asset transactions, while AI enables anomaly detection, predictive analytics, and intelligent resource allocation. The system supports real-time tracking of medical equipment, reduces operational costs, and improves accountability through decentralized data sharing. Simulation results and prototype implementation demonstrate improved data integrity, optimized resource utilization, and increased resilience against cyber threats. This study highlights the transformative potential of integrating AI and blockchain technologies in healthcare asset management, paving the way for smarter, more secure hospital ecosystems.

Keywords: Artificial Intelligence, Blockchain, Hospital Asset Management, Security, IoT

AI-ASSISTED CT & MRI IMAGE SEGMENTATION

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Abstract: Precise segmentation of anatomical structures and disease regions in Magnetic Resonance Imaging (MRI) and Computed Tomography (CT) is critical for diagnosis, treatment planning, and follow-up. Manual segmentation remains the clinical standard, requiring 30–60 minutes per scan and introducing inter-observer variability. These limitations hinder efficiency in time-sensitive environments such as oncology and trauma care. To address these challenges, this study compares AI-based segmentation techniques using convolutional neural networks (U-Net, nnU-Net) and transformer-based architectures (Swin-UNETR). Models were trained and validated on benchmark datasets including BraTS (brain MRI) and AMOS (multi-organ CT/MRI). Overall, AI-assisted CT and MRI segmentation offers transformative potential for clinical workflows by reducing annotation time, improving consistency, and delivering interpretable, high-precision outputs—advancing the path toward precision medicine.

Keywords: Medical imaging, artificial intelligence, deep learning, CT segmentation, MRI segmentation, AI-aided annotation, clinical decision support

AI-POWERED HEALTH CHECK KIOSK

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Abstract: The rising demand for accessible, affordable, and preventive healthcare underscores the need for intelligent self-service solutions. Existing health kiosks typically offer basic vital sign monitoring and printed reports but lack personalization, predictive capabilities, and integration with modern healthcare ecosystems. This paper proposes an AI-powered Smart Health Check Kiosk, a next-generation system designed to transform routine health screening into a predictive and personalized experience. The kiosk integrates multiple sensors to measure vital parameters such as blood pressure, heart rate, oxygen saturation, body temperature, weight, and BMI, with optional point-of-care blood tests (e.g., glucose, hemoglobin). The proposed model demonstrates how AI-enabled kiosks can evolve into comprehensive, predictive, and preventive healthcare hubs—marking a significant advancement in digital health innovation.

Keywords: Artificial Intelligence, health kiosk, preventive healthcare, vital monitoring, Health Risk Score, digital health, personalized screening, public health.

AI-ASSISTED PORTABLE ULTRASONIC SCANNER FOR RURAL HEALTHCARE

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Abstract: Access to quality diagnostic imaging remains a major challenge in rural and low-resource healthcare environments. Ultrasound, known for its versatility, safety, and affordability, is often underutilized due to the scarcity of trained radiologists and the high cost of conventional equipment. This paper presents the development of an AI-assisted portable ultrasound scanner specifically designed for rural healthcare applications. The system integrates a low-cost hand held ultrasound probe with a mobile computing platform for image

acquisition and processing. Deep learning-based models are employed to automatically interpret ultrasound images, enabling frontline healthcare workers to detect conditions such as pregnancy complications, liver abnormalities, and cardiopulmonary disorders. The device supports wireless data transmission to cloud platforms, facilitating telemedicine consultations with specialists and ensuring timely diagnosis and treatment. By combining affordability, portability, and AI-driven decision support, the proposed solution addresses critical gaps in healthcare accessibility and enhances patient outcomes in underserved communities.

Keywords: Portable ultrasound, artificial intelligence, rural healthcare, diagnostic imaging, telemedicine

3D-PRINTED INSULIN-PRODUCING CONSTRUCTS USING BIOINKS FROM DECELLULARIZED PANCREATIC TISSUE

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Abstract: Diabetes type 1 therapy would benefit from implants capable of producing insulin in response to glucose. Here, decellularized human pancreatic extracellular matrix is combined with alginate to form a bioink used for 3D printing of islet-like cell constructs. The constructs maintain viability and secrete insulin in vitro over several weeks, responding to glucose stimulation. Immunogenicity assays show reduced immune activation compared to primary islet transplants. Preclinical animal model studies are underway. This method promises a tissue engineered alternative to islet transplantation with better stability and reduced need for donor tissue.

Keywords: 3d-printed, insulin-producing, bioinks, decellularized pancreatic tissue

SMART ICU AIR QUALITY MANAGEMENT USING AI

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Abstract: In intensive care units (ICUs), maintaining optimal environmental conditions—particularly temperature and humidity—is essential, as these factors are closely linked to infection rates. This study presents a low-cost, Arduino-based sensor system for continuous monitoring of ICU air quality, designed to enhance patient safety and environmental control. The system integrates a DHT sensor for temperature and humidity, and an MQ-135 gas sensor for detecting air pollutants, all connected to a microcontroller. Sensor readings are displayed on an LCD, and unsafe conditions trigger visual (LED) and auditory (buzzer) alerts. The use of open-source hardware and readily available components ensures affordability and scalability across multiple ICU wards. Prototype testing was conducted using the Wokwi simulation platform and physical breadboard setups to validate performance under realistic conditions. Future enhancements will incorporate AI-driven analytics, including machine learning models to predict short-term air quality trends and dynamically adjust threshold settings. This aligns with emerging IoT-enabled environmental monitoring systems that leverage embedded AI for robust and scalable management. By delivering real-time alerts and predictive insights, the proposed system offers a practical and cost-effective solution for improving ICU air safety and supporting patient recovery in critical-care environments.

Keywords: ICU, air quality monitoring, Arduino, IoT, DHT sensor, MQ-135, patient safety, artificial intelligence

AUTOMATIC PATIENT VITAL MONITORING BED

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Abstract: In modern healthcare, continuous monitoring of patient vital signs is essential for timely intervention and effective treatment. Conventional systems often rely on manual observation, which can lead to delays and human error in detecting critical changes. This paper presents the design and development of an Automatic Patient Vital Monitoring Bed, integrating biomedical sensors with an embedded microcontroller for real-time health tracking. The system is equipped to measure temperature, heart rate, oxygen saturation (SpO₂), respiration rate, and bed occupancy. Sensor data is processed by a microcontroller and transmitted via IoT-based communication for remote monitoring. In case of abnormal readings, the system activates an alert mechanism to notify medical personnel instantly. This design aims to reduce the workload of healthcare providers, enhance patient safety, and enable continuous monitoring in both hospital and home-care settings. Experimental evaluation confirms the system's reliability in capturing vital parameters with acceptable accuracy compared to conventional devices. The study underscores the potential of smart healthcare beds in advancing patient care through automation and IoT-enabled monitoring.

Keywords: Patient Monitoring, Smart Bed, IoT Healthcare, Vital Signs, Biomedical Sensors

POST-SURGERY REMOTE MONITORING UNIT

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Abstract: Post-surgical care is critical to patient recovery, as complications such as infections, irregular vital signs, and delayed healing frequently arise after hospital discharge. Traditional follow-up methods are limited by infrequent clinical visits and delayed recognition of health risks. To address these challenges, this paper proposes a Post-Surgery Remote Monitoring Unit (PSRMU) that integrates wearable sensors, IoT-based communication, and AI-driven analytics to continuously monitor vital parameters including heart rate, blood pressure, oxygen saturation, body temperature, and wound status. The collected data is securely transmitted to healthcare providers via a cloud-based platform, enabling real-time monitoring, early anomaly detection, and timely medical intervention. This system reduces hospital readmissions, lowers healthcare costs, and enhances patient comfort by supporting recovery in home settings while maintaining clinical supervision. The proposed solution prioritizes reliability, data privacy, and user-friendly interfaces for both patients and clinicians, contributing to improved post-operative outcomes and elevating the quality of healthcare delivery.

Keywords: Post-surgery care, remote monitoring, wearable sensors, IoT healthcare, AI analytics, patient recovery

SMART SELF-HEALING IMPLANTS FOR BIOMEDICAL APPLICATIONS

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Abstract: Smart self-healing implants represent a transformative advancement in biomedical engineering, offering enhanced durability, functionality, and biocompatibility for long-term therapeutic use. These implants are constructed using responsive materials capable of autonomously repairing micro-damages caused by mechanical stress, corrosion, or biological interactions—significantly extending their operational lifespan and reducing the need for revision surgeries. By integrating stimuli-responsive polymers, shape-memory alloys, and bioactive coatings, these systems can detect damage, initiate healing processes, and adapt to dynamic physiological environments. Applications span orthopedic, dental, cardiovascular, and neural implants, where reliability and seamless integration with host tissue are essential. This paper explores the design principles, material innovations, and clinical potential of smart self-healing implants, emphasizing their role in advancing personalized and regenerative medicine. These technologies pave the way for next-generation biomedical devices that are resilient, adaptive, and tailored to individual patient needs.

Keywords: Smart self-healing implants, biomedical engineering, responsive materials, regenerative medicine, shape-memory alloys, bioactive coatings

TELEMEDICINE FOR RURAL AND REMOTE COMMUNITIES

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Abstract: Telemedicine has emerged as a transformative solution to bridge the healthcare gap in rural and remote communities. Limited access to hospitals, shortage of medical specialists, and high travel costs often prevent timely medical intervention in these regions. By leveraging digital technologies such as video consultations, mobile health applications, and remote monitoring devices, telemedicine enables patients to connect with healthcare professionals without the need for physical visits. This approach reduces delays in diagnosis and treatment, enhances the quality of care, and supports preventive healthcare, emergency response, and continuous follow-up for chronic conditions. With adequate infrastructure, training, and policy support, telemedicine can significantly strengthen rural healthcare systems and promote equitable access to medical services.

Keywords: Telemedicine, rural healthcare, remote monitoring, digital health, chronic disease management

TEMPERATURE-BASED DRUG STORAGE ALERT

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Abstract: Proper drug storage is critical to preserving pharmaceutical safety, efficacy, and shelf life. Many medications are highly sensitive to temperature fluctuations, and exposure to unsuitable conditions can degrade potency or cause harmful effects. This project, Temperature-Based Drug Storage Alert, proposes a reliable system that continuously monitors the storage environment and alerts users when temperature deviates from the permissible range. The system integrates temperature sensors with a microcontroller-based alert mechanism that activates visual and audio notifications upon crossing critical thresholds. This enables timely corrective actions to maintain drug quality. Designed to be cost-effective and user-friendly, the solution is adaptable for use in hospitals, pharmacies, and domestic settings-contributing to improved healthcare safety and efficient pharmaceutical management.

Keywords: Drug storage, temperature monitoring, alert system, pharmaceutical safety

NANOTECHNOLOGY FOR TARGETED DRUG DELIVERY

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Abstract: This project investigates the application of nanotechnology in targeted drug delivery systems to achieve precise, efficient, and safe therapeutic outcomes. Nanoparticles are employed to encapsulate drugs, allowing for controlled release and targeted delivery to specific cells or tissues. The proposed approach involves designing nanoparticles with customized surface properties and optimized drug loading capacities to enhance therapeutic efficacy while minimizing side effects. Experimental results demonstrate improved precision in drug delivery and reduced toxicity compared to conventional methods. The system is scalable, cost-effective, and particularly suitable for treatments requiring localized and controlled drug release. This work highlights the potential of nanotechnology to revolutionize therapeutic strategies and contributes to the advancement of next-generation personalized medicine.

Keywords: Nanotechnology, targeted drug delivery, nanoparticles, controlled release, therapeutic efficacy, drug delivery systems

MICRONEEDLE PATCHES FOR PAINLESS VACCINE DELIVERY

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Abstract: Microneedle patches (MNP) are an emerging technology for painless vaccine delivery through the skin. These tiny projections penetrate only the outer skin layer, targeting immune-rich zones without causing discomfort. MNPs come in various forms—solid, coated, dissolvable, and hollow—each designed for specific release mechanisms and vaccine formulations. Their ability to maintain vaccine stability without refrigeration makes them ideal for resource-limited settings. Easy application, reduced dosage requirements, and elimination of sharp waste enhance safety and accessibility. Clinical trials for measles-rubella, influenza, and COVID-19 have shown strong immune responses and high patient acceptance. Despite promising results, challenges remain in large-scale manufacturing, regulatory approval, and public adoption. With continued innovation and collaboration, MNPs could revolutionize immunization strategies worldwide.

Keywords: Microneedle patches, painless vaccination, transdermal vaccine delivery, dissolvable micro needles, intradermal immunization, needle-free vaccines

AI-BASED PRESCRIPTION VERIFICATION FOR ERROR-FREE HEALTHCARE

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Abstract: Prescription errors—such as misinterpretation of handwriting, incorrect dosages, and unsafe drug combinations—pose serious risks in healthcare. This project presents a lightweight, AI-based prescription verification system designed to detect such errors using Natural Language Processing (NLP) techniques. Built with Python and Streamlit, the system analyzes digital prescription text against a drug database to identify misspelled names, duplicates, and basic drug interactions. Real-time alerts are displayed through a user-friendly interface. The prototype demonstrates how automation and AI can reduce human error in medical documentation. Though not yet hospital-ready, it serves as a valuable educational tool and foundation for future integration with EMR systems and advanced machine learning models.

Keywords: Prescription verification, NLP, AI in healthcare, error detection, biomedical informatics, miniproject

IOT-BASED HEALTH MONITORING SYSTEM

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Abstract: The Internet of Things (IoT) has transformed healthcare by enabling real-time, remote monitoring of patients' vital signs. This project introduces an IoT-based health monitoring system that continuously tracks parameters such as body temperature, heart rate, SpO₂, and ECG. Biomedical sensors connected to a microcontroller (Arduino/Raspberry Pi) collect and process data, which is transmitted wirelessly to a cloud server via Wi-Fi or GSM. Healthcare professionals and family members can access this data through web or mobile applications. In case of abnormal readings, alerts are sent via SMS or app notifications to ensure timely intervention. This system enhances patient care, supports early diagnosis, and improves chronic condition management—especially for elderly or remote patients—while reducing hospital workload and improving safety.

Keywords: IoT, health monitoring system, vital signs, biomedical sensors, Arduino, Raspberry Pi, cloud server, remote healthcare, real-time alerts, chronic disease management

PREDIHEALTH: TELEMEDICINE AND PREDICTIVE ALGORITHMS FOR THE CARE AND PREVENTION OF PATIENTS WITH CHRONIC HEART FAILURE

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Abstract: Managing chronic heart failure (CHF) requires continuous monitoring, early detection of complications, and personalized care strategies. The PrediHealth project addresses these needs by integrating telemedicine, mobile health (m-health), and predictive analytics into a unified digital platform. Developed in collaboration with a CPS/IoT-focused software industry, the system includes an IoT-enabled web application, a telemonitoring kit with medical and environmental sensors, and AI-driven models to support clinical decisions. The methodology involves CPS/IoT research, system prototyping, predictive model development, and validation in healthcare settings. PrediHealth enhances patient engagement, reduces hospitalizations, improves continuity of care, and lowers healthcare costs—demonstrating the potential of AI-powered telehealth for chronic disease management.

Keywords: Telemedicine, chronic heart failure, predictive analytics, IoT healthcare, mobile health, AI in healthcare, CPS systems

BIOMATERIAL BONE IMPLANTS THAT RELEASE ANTIBIOTICS DURING DEGRADATION

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Abstract: Bone infections following orthopedic surgeries pose serious challenges to patient recovery and implant success. This project investigates the development of biodegradable bone implants that release antibiotics during in vivo degradation. The implant matrix is designed to provide structural support while gradually releasing therapeutic doses of antibiotics at the surgical site. This localized delivery reduces systemic side effects, lowers the risk of antibiotic resistance, and accelerates osseointegration. The study emphasizes material selection, degradation kinetics, and drug-release profiles to ensure sustained antibacterial activity throughout the healing phase. The proposed solution demonstrates the potential of multifunctional biomaterials to enhance postoperative outcomes and redefine orthopaedic implant strategies.

Keywords: Biodegradable implants, antibiotic release, bone infection prevention, orthopaedic biomaterials, localized drug delivery

NEUROADAPTIVE SMART GLOVE FOR REAL-TIME COGNITIVE-RESPONSIVE HAND REHABILITATION

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Abstract: Hand rehabilitation is vital for patients recovering from stroke, neurological disorders, or motor impairments. While smart gloves assist in tracking hand movements, most lack responsiveness to cognitive and emotional states. This project introduces a Neuroadaptive Smart Glove that integrates EEG, EMG, GSR, and temperature sensors to deliver personalized, adaptive therapy. The glove monitors brain activity, muscle intent, and stress levels to dynamically adjust exercise difficulty and rest intervals using an AI-driven engine. Optional AR feedback and cloud connectivity enable remote therapist supervision and gamified rehabilitation. This multimodal system bridges physical action with neural intention, enhancing engagement and effectiveness—especially for users with partial paralysis or cognitive fatigue. Prototype testing shows promising adaptability and potential for scalable remote therapy.

Keywords: Neuroadaptive glove, hand rehabilitation, EEG, EMG, GSR, AI in physiotherapy, cognitive-responsive therapy, remote rehabilitation

IOT-BASED PROSTHETIC LIMB WITH GESTURE AND EMG CONTROL

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Abstract: The integration of advanced control systems into prosthetic limbs has significantly enhanced functionality and user experience for amputees. This project presents an IoT-enabled prosthetic limb that combines gesture recognition and electromyography (EMG) signals for intuitive control. Surface EMG sensors capture muscle activity, while an inertial measurement unit (IMU) detects hand and arm gestures. These inputs are processed in real time by a microcontroller to generate responsive limb movements. IoT capabilities enable remote monitoring, data logging, and performance analysis via a cloud-based platform. Experimental results show improved accuracy, adaptability, and responsiveness compared to traditional systems. This hybrid approach bridges the gap between natural limb function and artificial replacements, offering a smarter, connected solution for prosthetic technology.

Keywords: Prosthetic limb, IoT, electromyography (EMG), gesture control, human-machine interface, smart healthcare

ENERGY MANAGEMENT SYSTEM FOR HYBRID RENEWABLE ENERGY-BASED ELECTRIC VEHICLE CHARGING STATION

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Abstract: The growing demand for electric vehicles (EVs) calls for sustainable and efficient charging infrastructure. This project presents an Energy Management System (EMS) for a hybrid renewable energy-based EV charging station that integrates solar and wind power sources. The system is designed to optimize energy flow between renewable inputs, battery storage, and EV loads using smart control algorithms. A microcontroller-based setup monitors energy generation, consumption, and grid interaction in real time. The EMS ensures minimal grid dependency, prioritizes renewable usage, and enables load balancing during peak hours. Cloud connectivity allows remote monitoring and performance analytics. This solution promotes eco-friendly mobility, reduces carbon footprint, and supports decentralized energy systems for future smart cities.

Keywords: Energy management system, electric vehicle charging, hybrid renewable energy, solar power, wind energy, smart grid, microcontroller, sustainable mobility

A LARGE LANGUAGE MODEL (LLM)

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Abstract: Large Language Models (LLMs) are transformative AI systems that leverage deep learning and transformer architectures to process and generate human-like language. Trained on vast datasets, LLMs excel in tasks such as text generation, summarization, translation, and conversational interaction. Their applications span education, research, healthcare, and enterprise automation. However, LLMs also present challenges including ethical risks, high resource consumption, and limited interpretability. This paper explores the foundations of LLMs, their diverse applications, and the technical and societal challenges they pose. Future directions include developing efficient architectures, enhancing fairness and transparency, and integrating multimodal capabilities. LLMs represent a pivotal advancement in AI, with ongoing research essential for responsible deployment and governance.

Keywords: Large Language Model, transformer architecture, deep learning, NLP, AI ethics, multimodal AI, responsible AI

NON-INVASIVE ATHLETIC MONITORING SYSTEM

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Abstract: Athletic performance and recovery depend on continuous monitoring of physiological and biomechanical parameters. Traditional methods often involve invasive or bulky devices that hinder natural movement and reduce accuracy. This project introduces a Non-Invasive Athletic Monitoring System that uses wearable and environmental sensors to track heart rate, oxygen saturation, body temperature, hydration level, and motion dynamics in real time. The system applies advanced signal analysis and machine learning to detect fatigue, injury risk, and performance trends. Wireless connectivity enables seamless data transmission to mobile or cloud platforms, offering instant, personalized insights for athletes and coaches. This unobtrusive solution enhances training efficiency, supports injury prevention, and optimizes athletic performance.

Keywords: Non-invasive monitoring, athletic performance, wearable sensors, machine learning, real-time tracking, sports technology

AI-POWERED “DIGITAL LIGAMENT”: WEARABLE SLEEVE FOR PREDICTING LIGAMENT STRAIN AND INJURY PREVENTION

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Abstract: Ligament injuries are a major concern for athletes, often leading to long recovery periods and reduced performance. Existing wearables focus on external motion but lack real-time insight into internal ligament strain. This project introduces the AI-powered “Digital Ligament”, a smart wearable sleeve designed to predict ligament stress before injury occurs. It integrates motion sensors, surface electromyography (EMG), and pressure mapping to collect multidimensional biomechanical data. Machine learning models trained on healthy and injury-prone movement patterns analyze this data to detect abnormal load distribution and dynamic stress. The system provides real-time alerts to athletes and coaches, enabling timely corrective actions. Beyond injury prevention, it supports rehabilitation tracking and personalized training, advancing sports medicine toward proactive, data-driven care.

Keywords: Digital ligament, wearable sleeve, machine learning, ligament strain prediction, EMG, sports injury prevention, smart rehabilitation

DRONE-ASSISTED TELEMEDICINE DELIVERING

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Abstract: The integration of unmanned aerial vehicles (UAVs), or drones, into telemedicine systems is revolutionizing healthcare delivery, especially in remote and disaster-affected regions. This project presents a drone-assisted telemedicine framework designed to transport medical supplies, diagnostic tools, and real-time communication devices to patients and healthcare providers in geographically isolated areas. The system utilizes autonomous navigation, GPS-based routing, and IoT-enabled communication to ensure timely and reliable delivery. It also supports teleconsultation, enabling remote diagnosis and guidance from medical professionals. Performance evaluations show reduced response times, improved supply chain efficiency, and enhanced continuity of care during emergencies. The proposed solution offers a scalable, cost-effective model to strengthen healthcare infrastructure in underserved communities.

Keywords: Drone, telemedicine, UAV, healthcare delivery, IoT, remote healthcare, emergency response

TEMPERATURE SENSING PATCH FOR CONTINUOUS FEVER MONITORING

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Abstract: The rising demand for continuous health monitoring has driven innovation in wearable, non-invasive technologies for early disease detection. This project introduces a Temperature Sensing Patch designed for real-time fever tracking with high accuracy and reliability. The patch integrates a flexible temperature sensor capable of continuous measurement and wireless data transmission. A smart algorithm analyses temperature fluctuations to detect abnormal patterns and trigger timely alerts, reducing the risk of undetected fever and complications. IoT-based connectivity enables remote monitoring, data logging, and predictive analytics for early diagnosis. Prototype testing confirms enhanced measurement precision, user comfort, and effective real-time performance. This system demonstrates the potential of wearable temperature sensing in advancing personalized healthcare and preventive medicine.

Keywords: Temperature sensing patch, continuous fever monitoring, wearable health tech, IoT healthcare, predictive analytics, remote patient monitoring

SELF-HEALING AI PROSTHETICS FOR REHABILITATION

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Abstract: Prosthetic devices play a vital role in restoring mobility for patients, but they often suffer from wear, cracks, and frequent repairs-leading to increased costs and disrupted rehabilitation. This project introduces Self-Healing AI Prosthetics, a novel concept that combines smart materials with artificial intelligence to create more durable and responsive prosthetic systems. The prosthetic is constructed using bio-inspired materials capable of autonomously repairing minor damage, mimicking the healing process of human skin. Embedded sensors monitor stress, strain, and movement, while AI algorithms analyze this data to detect early signs of damage and predict future risks. Upon identifying a crack, the self-healing mechanism activates automatically, and the AI adjusts load distribution to maintain user safety. This innovation enhances reliability, reduces hospital visits, and ensures uninterrupted rehabilitation-offering a cost-effective and patient-friendly solution for long-term prosthetic care.

Keywords: Self-healing materials, artificial intelligence, smart prosthetics, stress-strain monitoring, predictive maintenance, damage detection, wearable technology, patient safety, continuous rehabilitation, bio-inspired design, cost-effective healthcare

GREEN CHARGE EMS

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Abstract: The increasing adoption of electric vehicles (EVs) demands sustainable and efficient charging infrastructure. This project presents an Energy Management System (EMS) for a hybrid renewable energy-based EV charging station that integrates solar and wind power sources. The system is designed to optimize energy flow between renewable inputs, battery storage, and EV loads using smart control algorithms. A microcontroller-based setup monitors energy generation, consumption, and grid interaction in real time. The EMS ensures minimal grid dependency, prioritizes renewable usage, and enables load balancing during peak hours. Cloud connectivity allows remote monitoring and performance analytics. This solution promotes eco-friendly mobility, reduces carbon footprint, and supports decentralized energy systems for future smart cities.

Keywords: Energy management system, electric vehicle charging, hybrid renewable energy, solar power, wind energy, smart grid, microcontroller, sustainable mobility

TELEMEDICINE

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Abstract: Telemedicine has emerged as a transformative tool in modern healthcare, bridging the gap between patients and providers by overcoming geographical, financial, and time-related barriers. With rapid advancements in digital health technologies, telemedicine now supports remote consultations, real-time monitoring, and effective chronic disease management—significantly improving healthcare accessibility and outcomes. This paper highlights telemedicine’s current applications in India, its critical role during the COVID-19 pandemic, and its growing relevance in rural and underserved regions. It also explores the integration of biomedical devices, electronic health records (EHR), and artificial intelligence (AI) to enhance diagnostic accuracy and patient care. Challenges such as data security, regulatory frameworks, and the need for standardized protocols are discussed. The study concludes that telemedicine, when effectively implemented, can complement traditional healthcare systems, promote equitable access, and support a more patient-centric and sustainable healthcare model.

Keywords: Telemedicine, digital health, remote monitoring, biomedical engineering, healthcare accessibility

SMART HEALTHCARE IMPLEMENTATION USING TELEMEDICINE PLATFORM

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Abstract: This project presents a Smart Healthcare Telemedicine Platform designed to deliver cost-effective, accessible, and real-time medical care. The system integrates IoT-based wearable sensors for continuous monitoring of vital signs such as heart rate, oxygen saturation, and blood pressure. An AI-powered diagnostic assistant interprets symptoms and supports clinical decision-making, improving accuracy and response time. Blockchain technology ensures secure and interoperable electronic health records. A smart scheduling and triage module prioritizes patients based on urgency, enabling timely treatment. Voice-based support in local languages enhances accessibility for rural and elderly populations. The platform also incorporates e-pharmacy integration and drone-based medicine delivery for remote areas. Overall, this intelligent telemedicine solution reduces costs, eliminates geographical barriers, and promotes preventive and predictive care—creating a scalable model for the future of digital healthcare.

Keywords: Smart healthcare, telemedicine, IoT-enabled wearable, remote patient monitoring, artificial intelligence, e-delivery, patient-centric system

AI-ASSISTED ULTRASOUND FOR EARLY DISEASE DETECTION

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Abstract: AI-assisted ultrasound is a cutting-edge diagnostic approach that integrates artificial intelligence with traditional ultrasound imaging to enhance early disease detection. By applying machine learning and deep learning algorithms, the system can identify subtle anomalies that may be missed by human interpretation, thereby improving diagnostic accuracy and reducing operator dependency. This technology supports faster clinical decision-making and is especially valuable in detecting conditions such as cancer, cardiovascular diseases, liver disorders, and prenatal complications. Its non-invasive nature, cost-effectiveness, and accessibility make it a promising tool for transforming healthcare delivery and improving patient outcomes.

Keywords: Artificial Intelligence, Ultrasound Imaging, Early Disease Detection, Machine Learning, Deep Learning, Diagnostic Accuracy, Healthcare Innovation

WEARABLE HAPTIC EXOSKELETON GLOVE

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Abstract: This project aims to develop a wearable haptic exoskeleton glove that delivers both kinesthetic and cutaneous feedback for enhanced interaction in virtual reality, teleoperation, and rehabilitation. Unlike conventional devices, the glove integrates tendon-driven mechanisms and soft materials to ensure flexibility, comfort, and precise haptic control. Tactile sensors and actuators simulate object properties such as texture, weight, and stiffness. Kinesthetic feedback is achieved through force transmission, while cutaneous feedback reproduces surface sensations. The dual-mode system improves perceptual fidelity, allowing users to feel both resistance and surface detail. Experimental evaluations will measure human perception of rendered forces and textures. Feedback strategies will be optimized for realism and sensitivity. Applications include robotic manipulation, immersive training, and therapeutic rehabilitation. This innovation advances wearable haptics by overcoming limitations of single-mode systems.

Keywords: Haptic glove, kinesthetic feedback, cutaneous feedback, wearable exoskeleton, virtual reality, teleoperation, rehabilitation, tactile sensors, tendon actuation, perceptual fidelity

LOW-COST MEDICAL DEVICES FOR RURAL HEALTH CARE

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Abstract: Wearable medical devices are transforming healthcare by enabling continuous, non-invasive monitoring of vital signs through intelligent sensors. These devices provide real-time physiological data that support early disease detection, diagnosis, and personalized management. Key parameters tracked include temperature, heart rate, SpO₂, respiration rate, blood glucose, sleep patterns, and activity levels. Technologies such as PPG, ECG, and CGM enhance cardiovascular and diabetic care, while accelerometer-based sleep analysis and activity tracking promote preventive health. Integrated platforms synchronize data to smartphones and cloud systems, supporting telemedicine and remote monitoring. This paradigm shift positions wearables as essential tools in proactive, patient-centered healthcare.

Keywords: Wearable medical devices, vital sign monitoring, non-invasive sensors, telemedicine, personalized healthcare, CGM, PPG, ECG, SpO₂, remote monitoring

TRANSDUCER AND WEARABLE HEALTH DEVICES

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Abstract: The integration of transducer technology with wearable health devices has revolutionized healthcare by enabling real-time, continuous, and non-invasive monitoring of physiological signals. Transducers convert biological parameters—such as pressure, temperature, heart rate, motion, and biochemical markers—into measurable electrical outputs. Advances in miniaturized sensors, low-power electronics, and IoT platforms have made wearable systems reliable tools for remote and home-based care. This paper reviews transducer design principles, classifications, and biomedical applications, focusing on cardiac monitoring, glucose detection, and activity tracking. It also addresses challenges like signal interference, calibration, user comfort, and data privacy. Emerging technologies in flexible electronics and nanomaterials are highlighted as enablers of next-generation wearables. A proposed framework outlines a cost-effective prototype using accessible biomedical transducers and wireless modules to improve healthcare accessibility. The study underscores the role of transducer-based wearables in early diagnosis, personalized treatment, and chronic disease management.

Keywords: Transducers, wearable health devices, physiological monitoring, IoT healthcare, cardiac sensors, glucose detection, flexible electronics, telemedicine, biomedical engineering

MEDICAL DEVICES AND INSTRUMENTATION

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Abstract: Medical devices and instrumentation are foundational to modern healthcare, enabling prevention, diagnosis, monitoring, and treatment across clinical settings. This multidisciplinary field combines biomedical engineering, electronics, materials science, and data analytics to develop tools ranging from basic diagnostics to advanced life-support systems. Key technologies include imaging (MRI, CT, ultrasound), monitoring (ECG, pulse oximeters), therapeutic (pacemakers, insulin pumps), and surgical instruments (robotics, endoscopes). Innovations in miniaturization, wireless communication, and AI have led to wearable and implantable devices that support real-time monitoring and personalized care. Regulatory frameworks from FDA and ISO ensure safety and reliability. Emerging trends in biosensors, nanotechnology, and telemedicine are expanding access, especially in remote areas. As healthcare demands evolve, medical instrumentation will remain central to improving global patient outcomes.

Keywords: Medical devices, biomedical instrumentation, diagnostics, wearable technology, AI in healthcare, biosensors, telemedicine, regulatory standards, personalized medicine

BIOMECHANICAL MODELLING AND HUMAN MOVEMENT ANALYSIS: APPLICATIONS IN SPORTS BIOMECHANICS AND JOINT REPLACEMENTS

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Abstract: Biomechanical modelling and human movement analysis are advancing rapidly, offering critical insights into musculoskeletal function, performance optimization, and rehabilitation strategies. Computational techniques now allow precise simulation of human motion, supporting applications in sports biomechanics, injury prevention, and orthopedic surgery planning. This paper explores the theoretical foundations and practical implementations of biomechanical models, emphasizing their role in sports performance evaluation and personalized joint replacement design. Emerging innovations such as machine learning and patient-specific modeling are reshaping the field, enabling more accurate diagnostics, tailored interventions, and improved clinical outcomes.

Keywords: Biomechanical modeling, human movement analysis, sports biomechanics, joint replacement, computational simulation, machine learning, orthopedic planning, patient-specific modeling

INTRACELLULAR MICROSTRUCTURE FABRICATION VIA TWO-PHOTON 3D PRINTING

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Abstract: Novel biomedical applications demand manipulation at subcellular scales. This research explores two-photon polymerization to fabricate functional microstructures **inside** living cells. Using a biocompatible photoresist delivered into cells, a femtosecond laser initiates polymerization at targeted locations, forming structures such as barcodes, diffraction gratings, or microlasers. The unpolymerized resist dissolves, leaving behind stable, submicron resolution constructs within the cellular cytoplasm. These intracellular devices are evaluated for cell viability, immune response, and functional integration. Potential applications include intracellular sensing, biomechanical modulation, or even targeted therapeutic delivery. (Based on recent developments.)

Keywords: intracellular microstructure fabrication , two-photon 3d printing

DRUG DELIVERY SYSTEMS (DDS)

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Abstract: Advances in molecular pharmacology and disease mechanism understanding have emphasized the need for precise targeting of diseased cells, especially in life-threatening conditions requiring potent therapeutic agents. Modern **Drug Delivery Systems (DDS)** address these challenges by enhancing site-specific transport, maximizing efficacy, and minimizing systemic exposure. Compared to conventional DDS, newer systems offer improved automation, precision, and performance. These platforms often utilize nanomaterials or miniaturized devices with multifunctional components that are biocompatible, biodegradable, and exhibit high viscoelasticity and extended circulation half-life. This review outlines the historical evolution and technological progress of DDS, highlights recent therapeutic applications, discusses associated challenges such as immune response and manufacturing complexity, and explores future directions for optimizing clinical translation. Ultimately, DDS play a pivotal role in advancing personalized and effective disease management.

Keywords: Drug delivery systems, targeted therapy, nanomaterials, biocompatibility, pharmacology, therapeutic efficacy, clinical translation, personalized medicine

BIOMECHANICAL MODELLING AND HUMAN MOVEMENT ANALYSIS: APPLICATIONS IN SPORTS BIOMECHANICS AND JOINT REPLACEMENTS

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Abstract: Biomechanical modelling and human movement analysis are advancing rapidly, offering critical insights into musculoskeletal function, performance optimization, and rehabilitation strategies. Computational techniques now allow precise simulation of human motion, supporting applications in sports biomechanics, injury prevention, and orthopedic surgery planning. This paper explores the theoretical foundations and practical implementations of biomechanical models, emphasizing their role in sports performance evaluation and personalized joint replacement design. Emerging innovations such as machine learning and patient-specific modeling are reshaping the field, enabling more accurate diagnostics, tailored interventions, and improved clinical outcomes.

Keywords: Biomechanical modeling, human movement analysis, sports biomechanics, joint replacement, computational simulation, machine learning, orthopedic planning, patient-specific modeling

ADAPTIVE, CONTEXT-AWARE VOLUMETRIC BIOPRINTING FOR VASCULARIZED TISSUES

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Abstract: Creating vascular networks within bioprinted constructs is essential for tissue survival post-implantation. This study presents GRACE (Generative, Adaptive, Context-Aware) volumetric bioprinting that integrates computer vision, imaging, and biofabrication to automatically generate vascular networks within cell-laden bioinks. The system detects existing tissue features and adapts printing path and geometry accordingly. Tests using vascularized cartilage and bone constructs demonstrate enhanced perfusion, cell survival, and functional maturation. The workflow reduces manual intervention, improves printing fidelity around embedded structures, and allows rapid fabrication—even with opaque features present. Such adaptive systems can accelerate tissue engineering toward clinical translation

Keywords: adaptive, volumetric bioprinting, vascularized tissues

ENGINEERING TARGETED THERAPEUTICS: ADVANCES, CHALLENGES & FUTURE DIRECTIONS IN DRUG DELIVERY SYSTEMS

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Abstract: Advances in molecular pharmacology and disease mechanism understanding have emphasized the need for precise targeting of diseased cells, especially in life-threatening conditions requiring potent therapeutic agents. Modern Drug Delivery Systems (DDS) address these challenges by enhancing site-specific transport, maximizing efficacy, and minimizing systemic exposure. Compared to conventional DDS, newer systems offer improved automation, precision, and performance. These platforms often utilize nanomaterials or miniaturized devices with multifunctional components that are biocompatible, biodegradable, and exhibit high viscoelasticity and extended circulation half-life. This review outlines the historical evolution and technological progress of DDS, highlights recent therapeutic applications, discusses associated challenges such as immune response and manufacturing complexity, and explores future directions for optimizing clinical translation. Ultimately, DDS play a pivotal role in advancing personalized and effective disease management.

Keywords: Drug delivery systems, targeted therapy, nanomaterials, biocompatibility, pharmacology, therapeutic efficacy, clinical translation, personalized medicine

SMART INFUSION TECHNOLOGY

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Abstract: Traditional infusion systems face challenges such as untimely medication replacement, difficulty in monitoring infusion levels, and risks of dosage errors. This study introduces a Smart Infusion Automatic Medication Replacement Device comprising three core modules: high-precision liquid level monitoring, automated medication replacement, and intelligent control systems. The device ensures accurate dosage delivery, minimizes waste, reduces manual intervention, and alleviates healthcare provider workload through rotational mechanisms, stabilization features, and automated calibration. All literature review highlights the broader role of smart infusion pumps in reducing medication errors, enabling remote integration, and improving patient safety. Despite benefits, challenges like alert fatigue, compliance issues, and programming errors persist. Proposed strategies include optimizing drug libraries, minimizing unnecessary alerts, and enhancing hospital system integration. Future opportunities lie in improving portability, implementing auto-programming, and designing user-friendly interfaces. Collectively, these innovations contribute to safer, more efficient infusion therapy and better healthcare outcomes.

Keywords: Smart infusion technology, automated medication replacement, dosage accuracy, healthcare efficiency, error prevention, remote monitoring, infusion therapy

RECENT ADVANCES IN THE DEVELOPMENT OF GENE DELIVERY SYSTEMS

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Abstract: Rapid progress in gene therapy over the past decade has been driven by parallel advances in gene delivery systems that enhance efficiency, specificity, safety, and manufacturability. Viral vectors such as adeno-associated viruses (AAVs) and lentiviruses remain powerful tools for durable gene expression and ex vivo cell engineering; however, ongoing efforts aim to reduce immunogenicity, expand tropism, and increase cargo capacity. In parallel, non-viral platforms—notably lipid nanoparticles (LNPs), biodegradable polymers, and hybrid lipid-polymer systems—have evolved rapidly, offering scalable and less immunogenic alternatives that enabled the success of mRNA vaccines and are now being adapted for targeted therapeutics and gene editing applications. Looking ahead, integrative approaches that combine optimized carrier design, precision targeting, and robust translational frameworks hold the potential to expand the therapeutic reach of gene therapies—transforming personalized medicine through safer and more accessible gene delivery technologies.

Keywords: Gene Therapy, Gene Delivery Systems, Viral Vectors, Non-Viral Carriers, Lipid Nanoparticles, CRISPR/Cas, Targeted Drug Delivery

BALANCING SAFETY AND INNOVATION: CHALLENGES AND OPPORTUNITIES IN EU MEDICAL DEVICE REGULATION COMPLIANCE

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Abstract: Medical devices are essential tools in modern healthcare, ranging from simple instruments like thermometers to advanced technologies such as pacemakers, imaging systems, and medical software. They play a critical role in diagnosis, monitoring, prevention, treatment, and rehabilitation—directly contributing to patient safety and improved outcomes. Despite its advantages, MDR presents challenges. Fragmented information creates compliance barriers, especially for small and medium-sized enterprises with limited resources. Larger companies adapt more easily. National agencies like Finland’s Fimea provide guidance and training but face criticism over effectiveness. Moreover, low awareness of EU-level ICT systems such as EUDAMED limits their utility in supporting compliance. Overall, while medical devices greatly enhance healthcare delivery, regulatory frameworks must strike a balance between safety and innovation. To maximize impact, stakeholders need accessible information platforms, effective training, and robust digital tools. Ensuring regulatory compliance across all enterprise sizes is vital for sustaining innovation and equitable access to safe medical devices.

Keywords: Medical Devices, Regulation, MDR, Patient Safety, Health Technology

FUTURE OF LEARNING IN THE CLINICAL ENVIRONMENT EXPLORING THE TECHNOLOGICAL REVOLUTION

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Abstract: The future of learning in the clinical environment is undergoing a transformative shift driven by rapid technological advancements. Traditional methods—centered on patient interaction, mentorship, and hands-on practice—are being redefined by digital innovations such as artificial intelligence (AI), virtual reality (VR), augmented reality (AR), and simulation-based platforms. These tools offer safe, immersive, and interactive learning experiences, enabling learners to navigate complex clinical scenarios without compromising patient safety. AI-powered decision support systems, electronic health records, and predictive analytics foster data-driven thinking and personalized care strategies. Emerging technologies like wearable devices, real-time monitoring, and digital twins provide continuous feedback, refining clinical decision-making. However, challenges remain—ethical concerns, digital literacy, data privacy, and preserving the human touch must be addressed. Ultimately, the clinical learning environment is evolving into a more adaptive, accessible, and patient-centered model, where technology complements and enhances traditional education.

Keywords: Clinical learning, technological revolution, artificial intelligence, virtual reality, future prospects, medical education

A WEARABLE INFRARED DEVICE FOR LOW-COST, A-I ENHANCED BONE HEALTH MONITORING

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Abstract: Osteoporosis is a widespread skeletal disease involved in progressive bone weakening and increased susceptibility to fractures, especially in the legs and hips. Traditional tests, including Dual-Energy X-ray Absorptiometry (DEXA), are still the clinical gold standard for quantifying bone mineral density (BMD) accurately, but these methods are expensive, involve hospital visits, and limit the possibility of repeated monitoring. The device is strapped to the leg and provides safe IR light through the skin to measure the scattering of light from the bone underneath to make inferences of bone quality. Machine learning routines, trained on calibration DEXA measurements, transform the scattering data to produce consistent BMD estimates within a clinically useful range. While not designed to supplant clinical assessment, this wearable system offers a convenient device for early osteoporosis detection and continuous monitoring beyond conventional clinical settings. By integrating affordability, usability, and artificial intelligence, the new device provides a promising solution to increase routine bone health evaluation and facilitate preventive treatment for vulnerable groups.

Keywords: Osteoporosis; Bone health; Bone mineral density (BMD); Wearable infrared device; Machine learning; Low-cost monitoring

ON-SITE 3D PRINTING OF BONE GRAFTS USING AN INTRAOPERATIVE BIOPRINTER

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Abstract: Fractures with irregular geometries often require custom bone grafts, delaying surgical repair due to graft shaping and fitting. We developed an intraoperative bioprinter (“glue-gun bioprinter”) that extrudes a composite of polycaprolactone, hydroxyapatite, and antibiotic additives directly onto the fracture site during surgery. The material cures at body temperature, conforms to irregular surfaces, and starts drug release immediately. Rabbit models show faster bone bridging, improved stability, and lower infection risk compared to conventional bone grafts or metal screws. This approach may reduce operation time and improve outcomes in complex orthopedic trauma

Keywords: on-site 3d printing , bone grafts, intraoperative bioprinter

NANOMATERIALS IN DRUG DELIVERY

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Abstract: Nanomaterials have been a game-changing tool in drug delivery because of their exclusive physicochemical characteristics like high surface area, tunability of size, and surface modification versatility. Nanomaterials offer enhanced bioavailability, targeted delivery, controlled release, and lower toxicity when compared to traditional drug carriers. Liposomes, dendrimers, polymeric nanoparticles, metallic nanoparticles, and carbon-based nanomaterials are some of the nanostructures being studied to improve therapeutic efficacy. These nanocarriers are able to traverse physiological barriers, i.e., the blood-brain barrier, and target drugs to diseased cells or tissues with reduced side effects. Functionalization of nanomaterials through incorporation of ligands, antibodies, or peptides also makes active targeting mechanisms possible. Nanomaterials also have important roles to play in delivering insoluble drugs and designing personalized medicine strategies. Though they hold great promise for their applications, issues like long-term toxicity, mass production, and regulatory clearance need to be resolved in order to translate them to the clinic. Nanomaterials, as a whole, are an incredible platform for next-generation drug delivery systems with better treatment outcomes for cancer, infectious disease, neurological disorder, and other disease areas.

Keywords: Nanomaterials, Drug delivery, Targeted therapy, Nanoparticles, Controlled release, Bioavailability, Biomedical applications

BIOMATERIAL IMPLANTS IN SKIN GRAFTING

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Abstract: Skin and soft tissue reconstruction can be super complicated because of how complex human tissue is and the issues that can come with it. Yeah, we have gotten a bit further in developing ways to make new skin with natural and synthetic biopolymers. However, they're still some issues that we need to work on before it's clinically useful. There's a difference in the way autologous skin grafts and bioengineered skin grafts work, but the first one is better than the second one. Autologous skin grafts are taken from a different place on the same body, while bioengineered skin grafts are made in a lab. There's a lot of reasons why the first one is better than the second one, but the main one is the healing process. The second one is an alternative to the first one, which is why it's not as good as the first one. Also, the medical field is growing, and there is a lot of promising alternatives to autografts and cadaver grafts. This is so important because of how one little thing can go wrong and turn into a big problem. For example, soft tissue management is needed for dental implants because it affects things like aesthetics, peri-implant health, and bone stability. Autogenous connective tissue grafts are the best choice for the job, but the new connective tissue graft substitutes (CTGS) are a good alternative.

Keywords: Biomaterial implants, skin grafting, tissue regeneration, biocompatibility, wound healing, 3D bioprinting, nanotechnology, extracellular matrix

REHABILITATION ENGINEERING IN PRACTICE: FLEXIBLE, EVIDENCE-BASED PATHWAYS FROM DISABILITY TO FUNCTION

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Abstract: Rehabilitation Engineering plays a vital role in enhancing recovery and functionality for individuals with disabilities. Despite lacking a universally accepted definition, rehabilitation is widely recognized for its effectiveness across age groups, causes, and stages of disability. It is most impactful when delivered in patient-centered, goal-oriented settings by a skilled multidisciplinary team, guided by the biopsychosocial model. Core interventions include exercise, task practice, education, and psychosocial support. Emphasis on self-management and patient engagement ensures personalized care and relevance. Due to the unpredictable nature of outcomes, flexible adaptation and continuous goal reassessment are essential. Evidence supports the effectiveness of return-to-work programs in reducing long-term sick leave and shows that multimodal rehabilitation lowers the risk of disability pensions. Early, integrated interventions—especially those combining medical and vocational rehabilitation—are more effective than delayed, single-mode approaches. Workplace integration is crucial for minimizing absenteeism and sustaining long-term recovery.

Keywords: Rehabilitation Engineering, biopsychosocial model, patient-centered care, multidisciplinary team, task practice, psychosocial support, self-management, return-to-work programs, multimodal rehabilitation, vocational integration, disability recovery

WEARABLE BIOMEDICAL SENSORS FOR CONTINUOUS HEALTH MONITORING

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Abstract: Wearable biomedical sensors have revolutionized healthcare by enabling real-time, continuous monitoring of vital physiological parameters outside traditional clinical settings. These devices combine advanced sensor technologies with wireless communication and data analytics to deliver personalized health insights. Parameters such as heart rate, blood pressure, oxygen saturation, body temperature, glucose levels, and physical activity are tracked using non-invasive or minimally invasive methods. Continuous monitoring supports early detection of abnormalities, enhances disease management, and improves patient compliance. For individuals with chronic conditions like diabetes, cardiovascular diseases, and respiratory disorders, wearable sensors offer timely alerts and data-driven decision support, reducing medical emergencies. Overall, wearable biomedical sensors represent a shift toward proactive, preventive, and patient-centered healthcare, bridging the gap between individuals and medical professionals through intelligent health monitoring.

Keywords: Wearable biomedical sensors, continuous health monitoring, vital signs, chronic disease management, IoT, artificial intelligence, data analytics, non-invasive sensors, predictive healthcare, patient-centered care

ADVANCES IN SMART DRUG DELIVERY SYSTEMS FOR PRECISION HEALTHCARE

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Abstract: The advancement of drug delivery systems has emerged as a transformative approach in modern healthcare, aiming to enhance therapeutic efficacy while minimizing adverse effects. Traditional methods often face limitations such as poor bioavailability, non-specific targeting, and fluctuating drug concentrations. Recent innovations in nanotechnology, biomaterials, and artificial intelligence have enabled the development of smart drug delivery platforms capable of controlled, site-specific, and sustained release of therapeutic agents. These systems not only improve patient compliance but also open new pathways for personalized medicine, particularly in the treatment of chronic and life-threatening diseases such as cancer, diabetes, and cardiovascular disorders. This paper explores the current trends, challenges, and future prospects of drug delivery technologies, emphasizing their role in revolutionizing clinical outcomes and advancing precision healthcare.

Keywords: Drug Delivery, Nanotechnology, Controlled Release, Targeted Therapy, Personalized Medicine.

DRUG DELIVERY MONITORING BY AI

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Abstract: Artificial Intelligence (AI) is revolutionizing drug delivery and monitoring by addressing key challenges such as inaccurate dosing, poor adherence, and delayed detection of side effects. By integrating data from electronic health records, wearable sensors, and smart drug delivery devices, AI enables real-time analysis and personalized treatment adjustments. Intelligent systems like AI-assisted infusion pumps, implantable microchips, and smart inhalers optimize dosage based on physiological feedback, enhancing safety and compliance. In fields like diabetes, oncology, and respiratory care, AI supports precision medicine through predictive analytics and continuous monitoring. Beyond delivery, AI improves pharmacovigilance by predicting drug interactions and alerting clinicians to adverse effects. Despite challenges like data privacy, algorithm transparency, and regulatory hurdles, collaborative efforts can ensure safe and effective implementation. AI-driven drug delivery marks a major advancement in personalized, proactive healthcare.

Keywords: Artificial Intelligence, drug delivery, real-time monitoring, smart devices, pharmacovigilance, precision medicine, machine learning, wearable sensors, personalized treatment, healthcare innovation

DEEP LEARNING APPROACHES IN MEDICAL IMAGE ANALYSIS: A CASE STUDY ON MRI SCANS

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Abstract: Medical image analysis has emerged as a critical field in healthcare, enabling early diagnosis, treatment planning, and monitoring of various diseases. Among the different imaging modalities, Magnetic Resonance Imaging (MRI) is widely used due to its non-invasive nature and superior soft tissue contrast. To address these challenges, deep learning approaches have gained significant attention for their ability to automatically extract hierarchical features and provide accurate predictions. This study focuses on the application of deep learning techniques, particularly Convolutional Neural Networks (CNNs), in the analysis of MRI scans. By leveraging large annotated datasets and advanced architectures, deep learning models can effectively detect abnormalities such as brain tumors, neurodegenerative diseases, and musculoskeletal disorders. In this case study, we review different deep learning methodologies, including supervised, unsupervised, and transfer learning approaches, that enhance MRI-based diagnostic workflows. The findings highlight that deep learning not only improves diagnostic accuracy but also assists radiologists by reducing workload and enabling real-time decision support.

Keywords: Deep learning, medical image analysis, MRI scans, convolutional neural networks, image segmentation, anomaly detection, clinical decision support, U-Net, autoencoders, healthcare AI

COMPUTATIONAL AND CLINICAL BIOMECHANICS: TOWARDS PRECISION MEDICINE AND PATIENT-SPECIFIC SOLUTIONS

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Abstract: Medical biomechanics is an interdisciplinary field that applies mechanical principles to biological systems, particularly the human body. It analyzes the structure, function, and motion of tissues and organs under various physical conditions, integrating anatomy, physiology, physics, and engineering to understand how mechanical forces influence health and disease. Clinically, biomechanics is vital in orthopedics, rehabilitation, prosthetics, and surgical planning. Joint mechanics inform implant design, while gait and posture analysis support mobility aids. In sports science, biomechanical modeling enhances performance and injury prevention. Cardiovascular applications include modeling blood flow and mechanical stress to understand conditions like aneurysms and arterial blockages. Recent advances in computational biomechanics, imaging, and materials science have enabled personalized medical solutions. Patient-specific simulations improve treatment planning and support precision medicine. Overall, medical biomechanics bridges engineering and healthcare, offering innovative tools for diagnosis, therapy, and device development—empowering biomedical engineering students to shape the future of patient care.

Keywords: Medical biomechanics, tissue mechanics, orthopedics, prosthetics, gait analysis, cardiovascular modeling, computational biomechanics, precision medicine, biomedical engineering

PATIENT-SPECIFIC 3D-PRINTED BONE SCAFFOLDS FOR LARGE BONE DEFECT REPAIR

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Abstract: Large bone defects resulting from trauma, tumor resection, or congenital conditions pose substantial challenges in orthopedic surgery. This study investigates the design and fabrication of patient-specific scaffolds using 3D-printed poly-caprolactone composites reinforced with bioceramics. Using CT imaging, defect geometries are reconstructed to generate custom pore architecture that optimizes both mechanical strength and nutrient diffusion. The scaffolds undergo in vitro testing for biocompatibility with osteoblasts, and in vivo implantation in a rodent critical-size defect model to assess bone regeneration over 12 weeks. Results show enhanced integration, increased vascularization, and near-native mechanical stiffness. These findings support the clinical translational potential of personalized 3D-printed bone scaffolds for complex defect repair.

Keywords: patient-specific, 3d-printed, bone scaffolds

BIOPRINTING VASCULARIZED SKIN GRAFTS USING MULTI-LAYER BIOINKS

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Abstract: Skin injuries such as burns or chronic ulcers demand grafts that not only cover the defect but also foster rapid healing and vascularization. This work develops a multi-layered skin graft via 3D bioprinting, combining layers of dermal fibroblasts, keratinocytes, and endothelial cells with suitable bioinks. The constructs are printed with microchannel networks to mimic vasculature and cultured in perfusion bioreactors. In vitro assays show improved cell survival, formation of capillary-like networks, and barrier function. Animal studies (in a full-thickness wound model) demonstrate faster wound closure, reduced scarring, and functional skin regeneration compared to standard grafts. This approach highlights how 3D bioprinting can produce complex grafts for better clinical outcomes.

Keywords: Bioprinting, Vascularized Skin Grafts

4D-PRINTED SMART IMPLANTS FOR CONTROLLED DRUG RELEASE IN ORTHOPEDICS

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Abstract: Implant-related infections and inflammation remain major complications in orthopedic surgeries. We propose a 4D-printed smart implant system that releases antibiotics and anti-inflammatory agents in response to body temperature or pH changes. Shape memory polymer composites, embedded with drug-loaded microspheres, are fabricated via 3D printing. In vitro release kinetics are measured under simulated physiological and pathological conditions. Biocompatibility is assessed with human osteoblast and macrophage cell lines. An animal model of implant infection demonstrates that the smart implant reduces bacterial load and inflammatory markers more effectively than passive implants, while maintaining structural integrity. The system promises to combine mechanical function with responsive therapeutic delivery.

Keywords: 4d-printed, smart implants

VOLUMETRIC 3D PRINTING OF MICROFLUIDIC ORGAN-ON-CHIP PLATFORMS

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Abstract: Organ-on-chip platforms offer powerful tools for disease modeling and drug screening, but fabrication of complex microfluidic networks remains technically challenging. In this study, volumetric 3D printing (rapid light-based additive manufacturing) is used to fabricate microfluidic chips with embedded vascular-like channels in minutes. The chips are designed for liver tissue models, integrating hepatocytes, Kupffer cells, and endothelial cells. Perfusion culture maintains high cell viability over several weeks. Drug toxicity assays (acetaminophen and others) yield more physiological responses than static cultures. This method could accelerate development and scalability of organ-on-chip systems for pharmaceutical and disease research.

Keywords: volumetric 3d printing , microfluidic ,organ-on-chip

SELECTIVE ULTRASONIC MELTING FOR TUNABLE POROSITY IN 3D PRINTED SCAFFOLDS

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Abstract: Scaffold porosity critically influences cell infiltration, nutrient flow, and mechanical strength in tissue engineering. This work introduces a novel method, Selective Ultrasonic Melting (SUM), for 3D printing of poly(ϵ -caprolactone) scaffolds with tunable and controllable porosity. A water-mixed PCL powder is melted selectively by focused ultrasound in defined volumes. Micro-computed tomography and flow tests characterize pore distribution and connectivity. Cytocompatibility assays with fibroblast cells confirm viability and colonization. This technique offers an alternative to traditional extrusion or melt-based methods, enabling fine control over porosity and hence suitability for different tissue engineering applications. (Adapted from recent work).

Keywords: Ultrasonic Melting, Tunable Porosity, 3d Printed

ADVANCES IN MEDICAL BIOMECHANICS: MODELLING, ANALYSIS, AND APPLICATIONS IN HEALTHCARE

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Abstract: In medical biomechanics have increasingly leveraged computational modeling, experimental techniques, and multi-scale analyses to deepen our understanding of the mechanical behavior of biological systems. This interdisciplinary field integrates principles from engineering, physiology, and clinical sciences to inform diagnosis, treatment planning, rehabilitation, and the design of medical devices. Key developments include finite element analysis (FEA) of organ systems such as the heart, lungs, musculoskeletal structures, and soft tissues, enabling precise characterization of tissue mechanics, deformation patterns, and force transmission. Recent progress in bioengineering has facilitated the design of customized implants, scaffolds for regenerative medicine, and assistive devices while ensuring compatibility with patient-specific biomechanical constraints. High-resolution motion-capture, image-based computational modeling, and emerging AI-driven simulations have enhanced predictive capabilities, supporting individualized therapeutic strategies in orthopedics, cardiovascular care, respiratory and gastrointestinal interventions, sports medicine, and cellular mechanobiology. Hybrid computational frameworks that combine continuum, discrete, and multiscale modeling approaches now allow realistic simulation of tissue- and organ-level biomechanics while integrating microscale cellular mechanics. These innovations not only improve the precision of clinical decision-making but also provide insights into disease mechanisms, rehabilitation optimization, and surgical outcomes.

Keywords: Medical biomechanics, finite element analysis, computational modeling, tissue mechanics, organ bio mechanics, rehabilitation, implant design, personalized healthcare, multiscale modeling, mechanobiology.

ANALYSIS AND DETECTION OF AUTISM SPECTRUM USING ML

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Abstract: Autism Spectrum Disorder (ASD) is a complex neuro developmental condition marked by deficits. Leveraging diverse datasets encompassing behavioral, demographic, genetic, and clinical information, the proposed approach integrates data preprocessing, feature selection, and multiple ML algorithms, including Naïve Bayes, Support Vector Machines (SVM), Logistic Regression, K-Nearest Neighbors (KNN), Random Forest, Artificial Neural Networks (ANN), and Convolutional Neural Networks (CNN). Feature selection techniques, such as Binary Firefly Algorithm and Recursive Feature Elimination, are applied to identify the most significant predictors, enhancing classification accuracy while reducing computational complexity. The models are evaluated using standard metrics—accuracy, precision, recall, F1 score. CNN and ensemble methods demonstrate superior predictive performance, achieving accuracies exceeding 98% in multiple datasets. The results underscore the potential of noninvasive ASD detection, facilitating timely intervention, personalized therapy plans, and improved long-term outcomes.

Key words: Autism Spectrum Disorder (ASD), Support Vector Machines (SVM), Logistic Regression, K-Nearest Neighbors (KNN), Random Forest, Artificial Neural Networks (ANN)

CLASSIFICATION OF ORAL CANCER USING IMAGE PROCESSING METHODOLOGY

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Abstract: Oral cancer constitutes a major global health challenge, particularly prevalent in low- and middle-income countries, where late diagnosis is common and significantly reduces patient survival rates. Early detection of potentially malignant and malignant lesions in the oral cavity is critical for improving treatment outcomes. Recent advancements in image processing and deep learning techniques have offered promising avenues for automated, accurate, and cost-effective oral cancer diagnosis. This study presents a comprehensive methodology that integrates image acquisition, preprocessing, feature extraction, and classification using advanced Convolutional Neural Networks (CNNs) and optimized deep learning frameworks. Segmentation is employed to isolate lesion regions, while CNN-based feature extractors capture critical visual patterns, including texture, color, and morphological characteristics indicative of malignancy. Classification models, including EfficientNet, ResNet, DenseNet, and YOLO-based architectures, are optimized through techniques such as transfer learning, genetic algorithms, and ensemble learning to improve accuracy, sensitivity, and specificity. The proposed pipeline demonstrates high performance in distinguishing between benign, precancerous, and malignant lesions, achieving classification accuracies exceeding 95% in experimental datasets.

Key words: Convolutional Neural Networks (CNNs), EfficientNet, ResNet, DenseNet, and YOLO-based architectures

DETECTION AND MONITORING OF POWER LOSS DUE TO SOILING IN PHOTOVOLTAIC

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Abstract: Soiling accumulation of dust, dirt, and other particulates on solar panel surfaces—significantly reduces the efficiency of photovoltaic (PV) systems, leading to substantial power losses over time. This paper presents a comprehensive framework for detecting and monitoring power loss due to soiling using a combination of sensor data analysis, image processing, and machine learning techniques. The proposed system integrates irradiance and output power measurements with visual inspection data to quantify soiling impact in real-time. A predictive model is developed to estimate energy loss and recommend optimal cleaning schedules, enhancing system performance and reducing maintenance costs. Field experiments demonstrate the effectiveness of the approach in diverse environmental conditions, with improved accuracy over traditional threshold-based methods. This work contributes to smarter PV asset management and supports sustainable energy generation through proactive maintenance strategies.

Keywords: Photovoltaic Systems, Soiling Loss, Power Loss Detection, Image Processing, Machine Learning, Solar Panel Efficiency, Predictive Maintenance

ATTENTION-DRIVEN BRAIN TUMOR DETECTION IN MRI SCANS USING VISION TRANSFORMERS AND EXPLAINABLE HEATMAPS

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Abstract: Brain tumors are among the most serious and potentially fatal neurological conditions, where timely and accurate diagnosis is essential for effective treatment planning. Magnetic Resonance Imaging (MRI) is the most widely used non-invasive modality for brain tumor analysis due to its high-resolution structural imaging. However, conventional diagnostic approaches often rely on manual inspection by radiologists, which is time-consuming and prone to human error. To overcome these limitations, this project proposes an automated deep learning framework for brain tumor detection and classification using the Vision Transformer (ViT) architecture. The system is trained to classify MRI images into four categories: Meningioma, Pituitary, Glioma, and No tumor. Unlike convolutional neural networks, ViTs leverage self-attention mechanisms to capture long-range dependencies among image patches, thereby improving classification performance on complex medical datasets. Additionally, transformer-based attention features are used to generate heatmaps that highlight the most discriminative regions of MRI scans, enhancing model interpretability. These heatmaps act as visual explanations, supporting radiologists in understanding predictions and fostering trust in the system. The proposed framework integrates preprocessing for MRI data normalization, ViT-based classification for reliable tumor detection, and attention-guided visualization for clinical transparency. Experimental evaluation on benchmark brain tumor datasets demonstrates high accuracy and effective tumor localization.

Keywords: Brain Tumor Detection, MRI, Vision Transformer (ViT), Deep Learning, Heatmap Visualization, Medical Image Classification, Explainable AI

DEPARTMENT OF CIVIL ENGINEERING

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DURABILITY STUDY ON INCORPORATED MATERIALS

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Abstract : Durability is a critical aspect in civil engineering, as it ensures that structures can withstand environmental, chemical, and mechanical actions throughout their service life. Modern construction increasingly incorporates supplementary and alternative materials such as fly ash, ground granulated blast furnace slag (GGBS), silica fume, recycled aggregates, polymers, and fibers. These incorporated materials not only promote sustainability by reducing the dependence on natural resources and cement, but also influence the long-term performance of concrete and related composites. This study focuses on evaluating the durability characteristics of concrete and construction materials when modified with such incorporations. Key parameters such as resistance to chloride penetration, sulphate attack, carbonation, freeze–thaw cycles, water absorption, and permeability are considered. Experimental investigations reported in literature indicate that supplementary

Key Words: GGBS, Environmental stress, Thaw cycles

AI BASED DISASTER MANAGEMENT SYSTEM FOR SMART CITIES

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Abstract : AI-based disaster management systems for smart cities are transforming how urban communities prepare for and respond to emergencies, blending advanced technology with a human-centered approach. By integrating AI with networks of sensors, cameras, and communication devices throughout the city, these systems can detect disasters such as floods, fires, earthquakes, and industrial accidents in real time. AI continuously analyzes data from these sources, enabling rapid predictions and early warnings, which empower emergency services and city officials to act swiftly and effectively. During crises, AI-driven platforms coordinate evacuation procedures, optimize resource allocation, and provide real-time updates to both authorities and citizens, reducing confusion and improving safety.

Keywords: AI disaster management, smart cities, real-time monitoring, early warning systems, predictive analytics

AI BASED CRACK DETECTION IN CONCRETE STRUCTURES

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Abstract : AI-based crack detection in concrete structures is transforming how inspections and maintenance are performed, making these processes faster, safer, and more reliable. Modern AI solutions use computer vision and deep learning techniques to automatically analyze images captured from smartphones, drones, or specialized cameras, accurately identifying even tiny cracks that might be missed by the human eye. These systems can classify cracks by size and severity, track their growth over time, and alert engineers to potential structural risks, thus enabling timely repairs and preventing costly failures. By automating routine inspection tasks, AI frees workers from repetitive manual evaluations, allowing them to focus on higher-value engineering decisions. The technology also enhances collaboration and transparency by generating detailed, visual records of crack locations and dimensions.

Keywords: AI crack detection, concrete structures, computer vision, deep learning, image analysis

AI IN CONSTRUCTION PROJECT MANAGEMENT

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Abstract : Artificial intelligence is revolutionizing construction project management by making complex tasks more manageable and human-centric. AI tools in this field now assist teams with planning, scheduling, cost estimation, risk prediction, and resource management, enabling smoother project delivery and reducing common issues like delays and budget overruns. By analyzing massive amounts of data from ongoing and past projects, AI can forecast risks, suggest preventive steps before problems escalate, and automate repetitive tasks such as documentation and reporting, freeing up people to focus on value-added activities. AI-driven platforms bring a new level of collaboration by providing real-time analytics and predictive insights through customizable dashboards, mobile apps, and seamless integration with other construction software. These technologies optimize labor, materials, and equipment use, ensuring projects stay on schedule and within budget, while also improving safety.

Keywords: construction project management, artificial intelligence, scheduling, risk prediction, real-time analytics, collaboration

STUDY ON SUSTAINABLE CONCRETE BY USING INDUSTRIAL BY PRODUCTS

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Abstract : Concrete is the most widely used construction material worldwide, yet its production significantly contributes to greenhouse gas emissions, energy consumption, and depletion of natural resources. To address these challenges, the incorporation of industrial by-products as supplementary cementitious materials and partial replacements of natural aggregates has emerged as a promising strategy for developing sustainable concrete. This study explores the potential of by-products such as fly ash, ground granulated blast furnace slag (GGBS), silica fume, and other waste materials to enhance the environmental performance and engineering properties of concrete. The research focuses on evaluating mechanical strength, durability, and workability of mixes containing varying proportions of these materials, while comparing them with conventional concrete.

Keywords: Sustainable concrete, Industrial by-products, Fly ash, GGBS, Silica fume

ANALYZE SEISMIC DATA TO DEVELOP STRUCTURES WITH ENHANCED RESILIENCE TO EARTHQUAKE

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Abstract: The increasing frequency and intensity of earthquakes highlight the urgent need for designing structures with enhanced seismic resilience. This study focuses on the analysis of seismic data to understand ground motion characteristics, fault dynamics, and soil–structure interaction, enabling the development of safer and more adaptive structural systems. By employing advanced computational tools, machine learning algorithms, and real-time seismic monitoring, patterns in historical earthquake records and present seismic activity are examined to predict structural responses under varying seismic loads. The findings provide critical insights into optimizing structural design parameters, material selection, and damping mechanisms to mitigate damage during seismic events.

Keywords: Seismic data analysis, earthquake resilience, structural design, soil–structure interaction, ground motion

DURABILITY STUDY ON FLEXIBLE CONCRETE INCORPORATED WITH GGBS

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Abstract : Concrete remains the backbone of modern infrastructure, yet its long-term performance is often compromised due to durability issues arising from environmental exposures, structural loading, and inherent brittleness. Conventional concrete, while strong in compression, tends to exhibit poor tensile strength, limited strain capacity, and vulnerability to cracking under mechanical and environmental stresses. These limitations have stimulated the development of advanced materials such as flexible concrete, which offers a unique combination of strength, ductility, and resistance to cracking. At the same time, the construction industry faces urgent calls for sustainability, particularly in reducing the carbon footprint of cement production.

Key Words: GGBS, Environmental stress

CONCRETE CURING OPTIMIZATION USING AI AND IOT

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Abstract: Concrete curing plays a crucial role in determining the strength, durability, and overall performance of concrete structures. Traditional curing methods often rely on manual monitoring, which can lead to inconsistencies in temperature, humidity, and moisture control—factors essential for achieving optimal curing conditions. This study focuses on optimizing the concrete curing process using Artificial Intelligence (AI) and the Internet of Things (IoT). IoT sensors are embedded in concrete or placed on-site to continuously collect real-time data such as temperature, humidity, and moisture content. The gathered data is then analyzed using AI algorithms and machine learning models to predict curing performance, detect anomalies, and automatically adjust curing parameters for optimal results.

Key Words: AI, IoT, Algorithms

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING FOR ROAD ACCIDENT PREDICTION AND PREVENTION IN SMART TRANSPORTATION SYSTEMS

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Abstract : The rapid growth of urbanization and vehicle usage has led to a significant rise in road accidents, posing severe threats to human life and economic stability. To address this challenge, the integration of Artificial Intelligence (AI) and Machine Learning (ML) into smart transportation systems offers a promising solution for predicting and preventing road accidents. This study explores the application of AI and ML techniques to analyze diverse traffic-related data — including vehicle speed, road conditions, weather patterns, driver behavior, and historical accident records — to accurately forecast potential accident-prone scenarios. Predictive models, such as decision trees, neural networks, and support vector machines, are employed to identify risk factors and generate early warnings in real time.

Key Words: AI & ML, Traffic management

GENERATING ELECTRICITY AT FOOTPATH USING PIEZO-ELECTRIC MATERIALS

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Abstract : Our project focuses on generating electricity from footpaths by using the energy people create while walking. When pressure is applied to the footpath, piezoelectric sensors convert this mechanical energy into electrical energy. The electricity produced can be stored and used for useful purposes like streetlights, traffic signals, or charging small devices. This system is eco-friendly, cost-effective, and especially useful in crowded places such as railway stations, shopping malls, and city sidewalks. Through this idea, we aim to reduce dependence on traditional energy sources and contribute to building smarter and greener cities.

Key Words: Footpath, piezoelectric sensors

BIO–NANOSENSOR DATA+ AI FOR SELF HEALING CONCRETE

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Abstract : The rapid deterioration of concrete structures due to cracks, chemical attack, and environmental stressors poses a significant challenge to infrastructure sustainability and safety. Traditional repair and maintenance approaches are costly, time consuming, and often reactive rather than preventive. To address these limitations, this study proposes a novel integration of bio-nano sensor networks with artificial intelligence (AI) models for self-healing concrete systems. Bio-nano sensors, embedded within the concrete matrix, are designed to continuously monitor microstructural changes such as crack initiation, pH fluctuations, moisture levels, and ion diffusion. The data collected by bio-nano sensors is transmitted in realtime to an AI-based predictive analytics platform.

Key Words: Bio- inspired sensors, Nanoscale Sensing, AI-enabled Infrastructure, Self repairing concrete, Self-sustaining material.

AI-DRIVEN INNOVATIONS FOR SUSTAINABLE AND RESILIENT CIVIL INFRASTRUCTURE

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Abstract: Artificial Intelligence (AI) is emerging as a transformative force in the development of sustainable and resilient civil infrastructure. This paper explores AI-driven innovations that enhance infrastructure design, construction, maintenance, and disaster resilience. AI applications, including machine learning, deep learning, and computer vision, are employed for predictive maintenance, structural health monitoring, smart materials design, and optimization of energy-efficient and eco-friendly construction practices. The integration of AI accelerates data-driven decision-making, improves resource efficiency, reduces environmental impacts, and enhances the resilience of infrastructure against natural and anthropogenic hazards.

Keywords: Artificial Intelligence, Sustainable Infrastructure, Resilience, Predictive Maintenance, Structural Health Monitoring, Smart Materials, Civil Engineering.

ARTIFICIAL INTELLIGENCE IN CIVIL ENGINEERING: TRANSFORMING DESIGN, CONSTRUCTION, AND INFRASTRUCTURE MANAGEMENT

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Abstract : Artificial Intelligence (AI) is rapidly transforming the field of civil engineering by introducing advanced computational tools and intelligent decision-making capabilities that enhance the efficiency, accuracy, and sustainability of engineering projects. In design and planning, AI enables engineers to generate optimized structures, predict material behavior under complex loading conditions, and reduce human error through intelligent modeling and simulation. Construction processes are increasingly benefiting from AI-driven automation, robotics, and predictive maintenance systems, which streamline project timelines, reduce costs, and improve worker safety. AI also plays a crucial role in infrastructure management.

Keywords: Artificial Intelligence, Civil Engineering, Machine Learning, Deep Learning, Structural Design, Construction Management, Infrastructure Monitoring

ARTIFICIAL INTELLIGENCE IN SUSTAINABLE BUILDING MATERIALS AND SMART CITY DEVELOPMENT

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Abstract : The construction industry is undergoing a paradigm shift toward sustainability, driven by the urgent need to reduce carbon emissions, minimize waste, and optimize resource use. Artificial Intelligence (AI) has emerged as a transformative enabler in this transition, particularly when integrated with sustainable building materials and smart city frameworks. This paper explores the role of AI in advancing eco-friendly materials such as recycled composites, bamboo, hempcrete, and low-carbon concrete. It highlights AI's capabilities in predicting material performance, optimizing supply chains, and enabling life-cycle assessments. Furthermore, the study examines AI-driven innovations in construction, including robotics, predictive analytics

Keywords: Artificial Intelligence, Sustainable Construction, Smart Cities, Circular Economy, Digital Twins, Energy Efficiency, Green Materials

INTEGRATING AI WITH SUSTAINABLE BUILDING MATERIALS AND SMART CITY DEVELOPMENT

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Abstract: The integration of Artificial Intelligence (AI) with sustainable building materials and smart city development presents a transformative approach to urban planning, construction, and resource management. As cities worldwide face rapid urbanization, increasing energy demands, and environmental challenges, AI-driven solutions offer the potential to optimize the use of sustainable materials, enhance energy efficiency, and promote resilient infrastructure. This study explores the application of AI algorithms in material selection, structural design, and lifecycle assessment, enabling engineers to predict material performance, reduce waste, and minimize carbon footprints. Additionally, AI facilitates the development of smart city ecosystems by managing real-time data from sensors, IoT devices.

Keywords: Artificial Intelligence, Sustainable Building Materials, Smart Cities, Machine Learning, Urban Sustainability

STUDY OF SEISMIC RETROFITTING TECHNIQUES FOR EXISTING BUILDING

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Abstract : Increase the vulnerability of existing buildings to seismic hazards has enfaced the need for effective retrofitting strategies to ensure structural safety and resilience. Many structures, particularly those designed before the implementation of modern seismic codes, exhibit deficiencies in strength, ductility, and energy dissipation capacity, making them highly susceptible to earthquake-induced damage. This study investigates various seismic retrofitting techniques applicable to existing buildings, includes jack-fitting of structural members, addition of shear walls, base isolation, fiber-reinforced polymer wrapping, and use of energy dissipation devices. The research highlights the principal advantages and limitations of each method while evaluating their effectiveness in enhancing building performance under seismic loading.

Keywords: seismic hazards, jack-fitting.

PREVENTING SEISMIC WAVES EFFECTS ON STRUCTURES USING IOT DEVICES OVER SUPER STRUCTURES

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Abstract : Seismic Wave Absorption Material in Sub-Structure The mitigation of seismic forces in building foundations and sub-structures has become a critical concern in modern civil engineering. Traditional seismic design methods primarily focus on strengthening structural elements and allowing controlled deformation during earthquakes. However, recent advancements emphasize the integration of energy-absorbing and wave-dissipating materials within the sub-structure to reduce the transmission of seismic vibrations. Seismic wave absorption materials, such as engineered polymers, composites, geo-foam, and metamaterials, are designed to attenuate ground motion by converting seismic energy into heat or dispersing it through internal damping mechanisms.

Keywords: Seismic Wave, geo-foam, and metamaterials.

DEVELOPMENT OF BIO-DEGRADABLE ROOFING TILE MADE FROM COW-DUNG AND NATURAL FIBRE

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Abstract: The increasing demand for environmentally responsible building materials has prompted research into alternatives to conventional non-biodegradable roofing products. This study presents the design and evaluation of biodegradable roofing tiles fabricated from cow dung and natural fibres derived from sugarcane bagasse. The tiles were produced by blending processed cow dung with sugarcane fibres and binding agents, followed by moulding and curing. Mechanical testing was conducted to assess compressive strength, water absorption, and durability. Results indicate that the tiles demonstrate adequate strength for low-cost housing applications, coupled with thermal insulation and biodegradability advantages

Keywords : Biodegradable roofing tiles, cow dung, sugarcane fibres, sustainable construction, eco-friendly materials, natural composites.

SMART MONITORING OF HIGH-RISK STRUCTURE USING AI AND ML

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Abstract : High-risk structures such as bridges, dams, nuclear power plants, and skyscrapers play a vital role in modern infrastructure but are prone to severe damage and catastrophic failures if not continuously monitored. Traditional inspection techniques are labour-intensive, time-consuming, and often reactive rather than preventive. To address these challenges, this study proposes a smart monitoring system that leverages Artificial Intelligence (AI) and Machine Learning (ML) for real-time structural health monitoring. The system integrates IoT-enabled sensors, drones, and computer vision technologies to collect multidimensional data such as stress, strain, vibrations, and displacement. Using advanced ML algorithms like Convolutional Neural Networks (CNNs) and Long Short-Term Memory (LSTM) models

Keywords: High-risk structures, Convolutional Neural Networks (CNNs) and Long Short-Term Memory (LSTM) models.

ARTIFICIAL INTELLIGENCE IN STRUCTURAL ENGINEERING: TOWARDS SUSTAINABLE AND RELIABLE CONSTRUCTION

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Abstract: The integration of Artificial Intelligence (AI) into structural engineering marks a paradigm shift in how infrastructure is conceived, designed, constructed, and maintained. Modern societies demand safe, durable, and eco-friendly structures that can withstand growing environmental challenges while minimizing costs and resource consumption. AI, through its advanced capabilities such as machine learning, deep learning, computer vision, and optimization algorithms, offers unprecedented opportunities to achieve sustainable and reliable structural solutions. Ultimately, AI is not just a tool but a transformative force leading structural engineering toward a smarter, greener, and more reliable built environment.

Keywords: Engineered Cementitious Composites (ECC), artificial intelligence, Internet of Things (IoT) sensors.

AI-POWERED SMART REPAIR SYSTEM FOR ECC IN SUSTAINABLE INFRASTRUCTURE MANAGEMENT

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Abstract: The integration of Engineered Cementitious Composites (ECC) into sustainable infrastructure has transformed construction practices due to their superior strain-hardening, self-healing, and durability characteristics. However, the challenge lies in ensuring timely monitoring and repair of micro-cracks and progressive damage that may compromise long-term structural integrity. This paper presents an AI-powered smart repair system tailored for ECC structures. By integrating artificial intelligence, Internet of Things (IoT) sensors, and predictive analytics, the proposed system enables real-time detection, assessment, and automated response for repairing cracks before they escalate into significant failures. Machine learning models enhance the system’s ability to predict crack propagation, optimize repair timing, and minimize resource use.

Keywords: Engineered Cementitious Composites (ECC), artificial intelligence, Internet of Things (IoT) sensors.

AI-ENHANCED STRUCTURAL HEALTH MONITORING FOR RESILIENT INFRASTRUCTURE

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Abstract: The rapid expansion of urbanization and the increasing vulnerability of critical infrastructure to natural and human-induced hazards have highlighted the urgent need for advanced structural health monitoring (SHM) systems. Traditional SHM approaches, which primarily rely on manual inspections and conventional sensing technologies, often face limitations in terms of accuracy, scalability, and real-time responsiveness. To address these challenges, Artificial Intelligence (AI) is emerging as a transformative enabler for next-generation SHM frameworks. AI-enhanced SHM leverages advanced machine learning algorithms, deep learning models, and data fusion techniques to process vast and heterogeneous datasets generated by sensors, Internet of Things (IoT) devices, and unmanned aerial vehicles (UAVs).

Keywords: Structural Health Monitoring (SHM), Artificial Intelligence (AI), Machine Learning, Deep Learning,

SMART WASTE MANAGEMENT SYSTEM

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Abstract: Waste management has become one of the critical challenges in modern urban areas due to rapid population growth and increased waste generation. Traditional methods are often inefficient, leading to issues such as overflowing bins, high operational costs, and environmental hazards. A Smart Waste Management System integrates Internet of Things (IoT), sensors, cloud computing, and data analytics to provide an efficient and sustainable solution. Smart bins equipped with sensors monitor the fill level, type of waste, and environmental conditions in real time. This data is transmitted to a central system, enabling optimized collection routes, reduced fuel consumption, and timely waste disposal. Additionally, data analytics can predict waste patterns, support recycling, and encourage sustainable practices.

Keywords: *Internet of Things (IoT), sensors, cloud computing, sustainable urban development, Waste management*

STRUCTURAL HEALTH MONITORING BY AI

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Abstract: Structural Health Monitoring (SHM) plays a critical role in ensuring the safety, reliability, and sustainability of civil infrastructure such as bridges, dams, tunnels, and high-rise buildings. Traditional methods of inspection are often time-consuming, costly, and prone to human error. With the integration of Artificial Intelligence (AI) and Big Data, SHM has evolved into a more efficient, predictive, and real-time system. Big Data technologies allow the collection and processing of vast amounts of information from sensors, drones, and monitoring devices, capturing structural behavior under different environmental and loading conditions. AI techniques, including machine learning and deep learning, analyze these datasets to identify hidden patterns, detect anomalies, and predict possible structural failures.

Keywords: *Structural Health Monitoring, Artificial Intelligence, Big Data, Predictive Maintenance, Infrastructure Safety*

BUILDING CRACK DETECTION USING AI

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Abstract : Structural cracks in buildings are early indicators of potential damage and can compromise safety if not detected and addressed promptly. Traditional manual inspection methods are often time-consuming, labor-intensive, and prone to human error. This project proposes an automated crack detection system using Artificial Intelligence (AI) and Computer Vision techniques to identify and classify cracks in building surfaces with high accuracy. The approach involves collecting and preprocessing images of building structures, followed by training a deep learning model—such as a Convolutional Neural Network (CNN)—to detect and differentiate cracks from non-crack regions. The system can analyze images captured by cameras or drones, enabling real-time monitoring and remote inspection.

Keywords: *Structural cracks, Artificial Intelligence (AI) and Computer Vision techniques, Convolutional Neural Network (CNN)*

FLOOD CONTROL AND DRAINAGE SOLUTIONS USING MODERN TECHNOLOGIES

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Abstract : Flooding remains one of the most critical urban and rural challenges worldwide, intensified by rapid urbanization, climate change, and inadequate drainage infrastructure. Traditional flood control measures such as embankments and storm sewers, while effective to some extent, often fail under extreme rainfall events. Modern approaches emphasize integrated solutions that combine grey infrastructure, nature-based systems, and digital technologies to enhance resilience. This paper presents an overview of advanced flood control and drainage solutions, highlighting the role of nature-based interventions (such as green roofs, bioswales, permeable pavements, and wetlands) alongside engineered drainage improvements (detention basins, smart pumps, and upgraded sewer networks).

Keywords: *Flood control, drainage, smart cities, IoT, nature-based solutions, climate resilience*

AI BASED STRUCTURAL HEALTH MONITORING OF STEEL STRUCTURES

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Abstract : Structural Health Monitoring (SHM) is essential for maintaining the safety, durability, and performance of steel structures used in bridges, industrial plants, and high-rise buildings. Traditional SHM methods rely on periodic manual inspections and sensor-based data collection, which can be time-consuming, costly, and vulnerable to human error. The integration of Artificial Intelligence (AI) into SHM systems offers a powerful solution by enabling real-time, automated assessment of structural integrity. This study explores the application of AI techniques—such as machine learning algorithms, neural networks, and data analytics—in processing large volumes of sensor data collected from steel structures. These algorithms can detect early signs of damage, predict structural failures, and provide actionable insights without constant human intervention.

Keywords: SHM, Steel Structures

SMART TRAFFIC & AND URBAN INFRASTRUCTURE MANAGEMENT

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Abstract : The rapid pace of urbanization has intensified challenges in transportation systems and urban infrastructure, leading to congestion, pollution, and inefficiencies in resource utilization. Smart traffic and urban infrastructure management leverage advanced technologies such as the Internet of Things (IoT), artificial intelligence (AI), big data analytics, and intelligent transportation systems (ITS) to optimize mobility, improve safety, and enhance sustainability. Smart traffic solutions enable real-time monitoring of vehicular flow, adaptive traffic signal control, and predictive congestion management, thereby reducing travel time and emissions. Meanwhile, integrated urban infrastructure management focuses on efficient utilization of resources such as energy, water, and public services, ensuring resilience and adaptability in cities.

Keywords: Smart Traffic, Urban Infrastructure, IoT, Artificial Intelligence, Sustainability

AI AND IOT IN CONSTRUCTION SITE SAFETY

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Abstract : Construction sites are often risky places where accidents can happen because of unsafe working conditions, human mistakes, or lack of timely information. Traditional safety methods like manual checks and safety officers are useful but not always enough to prevent accidents. To solve this problem, Artificial Intelligence (AI) and the Internet of Things (IoT) can be combined to create a smarter and safer construction environment. IoT devices such as wearable sensors, smart helmets, and environmental detectors can collect real-time data on workers' health, location, and site conditions like temperature, dust, or harmful gases. Cameras and drones can monitor construction activities continuously. This large amount of data is then analyzed by AI, which can quickly identify unsafe practices,

Keywords: Artificial Intelligence (AI) and the Internet of Things (IoT)

AI-ENHANCED PAVEMENT AND TRAFFIC MANAGEMENT COMPUTER VISION FOR POTHOLE/CRACK DETECTION VIA DRONES AI FOR SMART TRAFFIC SIGNALS AND CONGESTION REDUCTION IN URBAN AREAS

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Abstract : Urbanization and increasing vehicular loads place unprecedented pressure on transportation networks, leading to accelerated pavement deterioration and chronic traffic congestion. Traditional inspection and traffic management methods are often reactive, resource-intensive, and limited in scope. Artificial Intelligence (AI) has emerged as a transformative enabler in pavement and traffic management, offering predictive, adaptive, and real-time solutions. This paper explores the integration of AI in pavement distress detection through computer vision and drone-based monitoring, highlighting its role in predicting maintenance needs, reducing costs, and extending infrastructure life cycles. Furthermore, it examines

Keywords: Artificial Intelligence, Pavement Management, Computer Vision, Smart Traffic Signals, Urban Mobility.

SCOPE OF AI APPLICATIONS IN DAMAGE ASSESSMENT OF HISTORICAL BUILDINGS

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Abstract : Artificial Intelligence (AI) is revolutionizing the field of heritage conservation by enabling advanced, data-driven approaches for the damage assessment of historical buildings. Traditional methods of inspection and evaluation are often time-consuming, invasive, and reliant on subjective judgment, which can compromise the integrity of heritage structures. AI applications, including computer vision, deep learning, and image recognition, allow for precise detection of cracks, material degradation, structural stress, and environmental impacts without physical intervention. These technologies can process large datasets from drones, 3D laser scans, and ground-based sensors to generate accurate digital models of heritage buildings. AI-powered predictive analytics further enable maintenance forecasting.

Keywords: Artificial Intelligence (AI), Damage Assessment, Historical Buildings, Deep Learning, Digital Heritage Management.

A REVIEW ON COMPUTER APPLICATIONS IN CIVIL ENGINEERING

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Abstract : Civil engineering has rapidly evolved with the integration of cutting-edge computer applications that enhance planning, analysis, design, and construction processes. This review explores the latest trends in computer applications reshaping the civil engineering landscape. Modern software such as Building Information Modeling (BIM), Geographic Information Systems (GIS), and advanced Computer-Aided Design (CAD) tools have become indispensable for ensuring precision, cost efficiency, and sustainability in infrastructure development. In structural engineering, programs like ETABS, STAAD.Pro, and SAP2000 enable high-accuracy modeling and performance-based design. Similarly, geotechnical tools like PLAXIS and GeoStudio facilitate advanced soil-structure interaction analysis. Emerging

Keywords: Building Information Modeling (BIM), Geographic Information Systems (GIS), Digital Twin Technology, Augmented Reality (AR)

ASSESSMENT OF IOT APPLICATION OBSTACLES IN SUSTAINABLE BUILDING PROJECTS

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Abstract : The rapid evolution of the Internet of Things (IoT) has unlocked unprecedented opportunities for transforming sustainable building projects into intelligent, responsive, and energy-efficient ecosystems. IoT applications enable real-time monitoring of energy consumption, indoor environmental quality, and occupant behavior, while supporting predictive maintenance and resource optimization to achieve green building standards. Despite these benefits, the implementation of IoT in sustainable construction faces critical obstacles that hinder its widespread adoption. This paper presents a comprehensive assessment of these challenges, focusing on the interplay between technological, organizational, and regulatory factors. Key obstacles include fragmented interoperability among devices and platforms, high initial costs of deployment

Keywords: *Internet of Things (IoT), Sustainable Building Projects, Implementation Barriers, Smart Construction Technologies, Cyber-security and Data Privacy*

APPLICATION OF AI AND ML IN CONSTRUCTION INDUSTRY TOWARDS FUTURE INDIA

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Abstract : Artificial Intelligence (AI) and Machine Learning (ML) are transforming the construction industry by enabling predictive analytics, process automation, and real-time decision making. In the context of Future India—marked by the development of smart cities, large scale infrastructure projects, and a growing focus on sustainability—AI and ML play a critical role in improving efficiency, safety, and cost-effectiveness. This paper reviews the latest trends in the application of AI and ML across the construction lifecycle, including design optimization, project scheduling, risk prediction, quality control, and resource management. this paper highlights the transformative potential of AI and ML in shaping a resilient and technology-driven construction ecosystem for Future India.

Keywords: *Artificial Intelligence (AI), Machine Learning (ML), Smart Construction Technologies, Predictive Analytics, Future India Infrastructure*

A STUDY ON AI BASED OPTIMIZATION OF FRP CONCRETE IN RETROFITTING

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Abstract : This study investigates the use of artificial intelligence (AI) to optimize fiber-reinforced polymer (FRP) composites in the retrofitting of concrete structures, aiming to enhance structural performance, durability, and cost-efficiency. Traditional retrofitting techniques using FRP often involve trial-and-error approaches, which can result in overdesign or material inefficiencies. This research introduces an AI-based optimization framework that integrates machine learning algorithms with structural engineering principles to systematically analyze and recommend the best retrofit configurations. The AI model evaluates multiple design parameters, including FRP thickness, fiber orientation, adhesive properties, and environmental exposure conditions, to find solutions that maximize strengthening effectiveness while minimizing material use and installation costs.

Keywords: FRP, AI optimization, Retrofitting.

STRUCTURAL DESIGN OPTIMIZATION AND COST REDUCTION USING GENERATIVE ARTIFICIAL INTELLIGENCE MODEL

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Abstract : In recent years, the rise of generative artificial intelligence (AI) has opened up exciting new possibilities for the field of structural engineering. This technology is helping engineers create more efficient and cost-effective designs. In this paper, we explore how generative AI models can be applied to structural design, focusing on improving performance while also cutting costs. We present a carefully crafted framework that blends AI-generated design with traditional engineering analysis. This ensures that all designs meet safety standards and fulfill functional requirements. Through a series of case studies on different structural systems, we demonstrate AI's impressive ability to innovate design configurations, use less material,

Keywords: generative artificial intelligence (AI), affordable building practices.

STUDY ON ACHIEVING SUSTAINABLE DEVELOPMENT GOALS USING 3D PRINTING TECHNOLOGIES IN CONSTRUCTION INDUSTRY

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Abstract : As the global focus shifts towards achieving sustainable development goals, the construction industry is increasingly adopting innovative methods to minimize its environmental impact and enhance efficiency. This paper investigates the potential of 3D printing technologies as a transformative force in the construction sector, aiming to align with the broader objectives of sustainability. By utilizing 3D printing, the study explores opportunities to significantly reduce material waste, decrease carbon emissions, and expedite building processes. These advancements promise not only to uphold, but also to exceed, current industry standards for quality and safety. The research includes detailed analyses and case studies that illustrate how 3D printing can revolutionize construction—from small-scale residential projects to expansive infrastructure—thereby contributing substantially to sustainable development efforts.

Keywords: 3D printing, sustainable development.

DESIGN ANALYSIS AND ESTIMATION OF RESIDENTIAL BUILDING

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Abstract— The construction of residential buildings requires a systematic approach involving design, analysis, and cost estimation to ensure structural safety, serviceability, and economic feasibility. This project focuses on the design analysis and estimation of a residential building, considering architectural, structural, and functional aspects. The structural design is carried out in compliance with IS codes for reinforced concrete members, including slabs, beams, columns, and foundations. Load calculations are based on dead load, live load, and environmental factors, ensuring stability and safety. The design process incorporates limit state methods to achieve both strength and serviceability requirements. Structural elements are proportioned to resist bending, shear, and axial forces while maintaining durability and economy. The estimation part involves quantification of materials such as cement, sand, aggregate, steel, bricks, and finishing items, followed by a detailed cost analysis to evaluate the financial requirements of the project.

Keywords - Residential Building, Structural Design, Estimation, RCC, IS Codes, Cost Analysis

AI TOOLS IN TRAFFIC ACCIDENT STUDIES: A COMPREHENSIVE FRAMEWORK FOR PREDICTION, DETECTION AND PREVENTION

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Abstract— This paper presents a comprehensive overview of artificial intelligence (AI) tools and methodologies applied to traffic accident studies, encompassing prediction, detection, and prevention systems. The integration of machine learning algorithms, computer vision technologies, and deep learning models has revolutionized traffic safety analysis by enabling real-time accident detection, predictive risk assessment, and proactive safety measures. This research examines current AI methodologies including Random Forest, neural networks, LSTM models, and convolutional neural networks (CNNs) for accident severity classification and real-time monitoring. The paper analyzes performance metrics across different AI approaches, revealing that ensemble methods and multi-modal data fusion significantly outperform traditional statistical models. Key findings indicate that AI-driven frameworks can reduce accident frequencies by 15% in pilot programs and achieve Mean Average Precision (mAP) of 0.893 in predictive analytics.

Keywords - Artificial intelligence, computer vision, deep learning, machine learning, traffic accident prediction, road safety, smart cities, autonomous vehicles, predictive analytics.

AN INTEGRATED IOT-BASED FRAMEWORK FOR REAL-TIME PERFORMANCE MONITORING AND DYNAMIC LIFE CYCLE ASSESSMENT OF GREEN BUILDINGS IN EMERGING ECONOMIES

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Abstract— This paper presents a novel integrated framework combining Internet of Things (IoT) technologies with dynamic life cycle assessment (LCA) methodologies for real-time performance monitoring of green buildings in emerging economies. The framework addresses the critical need for cost-effective sustainability monitoring solutions in developing markets through hybrid AI-IoT integration models. The proposed system utilizes environmental sensors, energy meters, and occupancy detection systems to continuously collect operational data, feeding into machine learning algorithms that optimize building performance while updating environmental impact calculations in real-time. A case study implementation using LSTM-MLP hybrid models demonstrated 15% improvement in RMSE and 12% improvement in MAE for energy consumption predictions compared to traditional static assessment methods. The framework incorporates adaptive algorithms specifically designed for resource-constrained environments, emphasizing low-hanging fruit technologies

Keywords - AI-IoT integration, building performance monitoring, dynamic life cycle assessment, emerging economies, energy efficiency,

TRAFFIC FLOW ANALYSIS AND CONGESTION MANAGEMENT IN PALAKKAD TOWN: A CASE STUDY

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Abstract— Traffic congestion is a significant manifestation of the negative externalities of urban road transport, leading to time delays, energy waste, air pollution, and reduced quality of life. These effects not only disrupt daily routines but also cause psychological stress and economic losses. One of the most impacted sectors is transportation, where congestion leads to increased travel time and higher operating costs. Time, being a non-renewable resource, is wasted extensively due to traffic delays, especially in busy intersections. This study focuses on evaluating the monetary impact of traffic delays at Kalmadadam Junction, a critical and congested road stretch experiencing heterogeneous traffic conditions. The estimation of congestion cost takes into account factors such as vehicle delay, traffic volume, passenger occupancy, and the value of travel time across different vehicle categories. Results reveal a substantial monetary loss due to delays, primarily in the form of opportunity costs. To mitigate these losses, appropriate traffic management strategies are essential.

Keywords - Traffic Congestion, Monetary Loss, Delay, Traffic Volume, Passenger Occupancy, Value of Travel Time, Opportunity Cost, Simulation, PTV Vissim.

DESIGN AND ESTIMATION OF LED BILLBOARD USING TEKLA SOFTWARE

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Abstract— Building Information Modeling (BIM) has transformed the architecture, engineering, and construction (AEC) sector by shifting from traditional, isolated workflows to a data-driven and coordinated process. For civil engineers, BIM is more than just design software—it is a comprehensive platform that integrates planning, design, analysis, construction, and maintenance into a streamlined workflow. The increasing demand for large-scale digital advertising has made structural safety, durability, and cost-effectiveness critical in the design of outdoor LED billboards. This study focuses on the design and estimation of a steel-framed LED billboard structure using Tekla Structures software. The design process integrates structural modeling, load analysis, and detailing of connections to ensure stability under dead loads, live loads, and environmental effects such as wind pressure.

Keywords - LED Billboard, Tekla Structures, Structural Design, Estimation, BIM, Wind Load Analysis

STUDY ON APPLICATION OF LEAN CONSTRUCTION TECHNIQUES FOR REDUCING WASTE ON CONSTRUCTION

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Abstract— The construction industry is one of the largest contributors to economic growth, but it faces persistent challenges such as cost overruns, time delays, low productivity, and excessive waste generation. Traditional construction practices often focus on isolated processes, resulting in inefficiency and poor value delivery to clients. Lean Construction offers a systematic, production-based approach that emphasizes value creation, waste elimination, and continuous improvement. This study explores the application of lean construction techniques to reduce waste in residential construction projects. Key lean tools such as the Last Planner System (LPS), 5S Workplace Organization, Just-in-Time (JIT) delivery, Pull Planning, and Value Stream Mapping (VSM) are examined for their effectiveness in identifying and minimizing non-value-adding activities. Data collection is based on observing various categories of waste, including transportation, inventory, motion, overproduction, over-processing, and defects.

Keywords - Lean Construction, Waste Reduction, Continuous Improvement, Last Planner System, Value Stream Mapping

ONE-PART ECO-GEOPOLYMER CONCRETE WITH MINIMAL CHEMICALS FOR SUSTAINABLE CONSTRUCTION

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Abstract— The growing need for sustainable construction materials has prompted the investigation of geopolymer concrete (GPC) as an environmentally benign alternative to traditional portland cement concrete. GGBS is added to the total binder at a weight of 15-25% to expedite early strength development, while silica fume is added at a weight of 5-10% to improve microstructural densification, reduce porosity, and increase durability. The one-part method embeds the activator inside the dry mix, making handling, storage, and on-site preparation easier than traditional two-part geopolymer systems that call for separate alkaline activator solutions. This approach enhances workability and construction practicality while consuming fewer chemicals. In order to optimize the mix proportions, laboratory studies have been carried out to examine the combined impacts of fly ash, GGBS, and silica fume on mechanical performance, workability, and setting time.

Keywords - Fly ash, GGBS, Silica fume, Compressive strength, Structural efficiency, Chloride penetration

PERFORMANCE EVALUATION OF GEOPOLYMER CONCRETE WITH NATURAL ADMIXTURES AND MARBLE POWDER

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Abstract: Geopolymer concrete (GPC) is a sustainable alternative to traditional Portland cement concrete, due to some environmental aspects the Portland cement production such as high energy consumption and significant CO₂ emissions is being accelerated so, the search for alternatives in the construction industry is increased. Geopolymer concrete (GPC), developed through the alkali activation of aluminosilicate-rich materials, has emerged as a feasible and eco-friendly substitute. This study explores the development and characterization of geopolymer concrete utilizing natural and industrial waste by-product like Corn Cob Ash (CCA), Sugarcane Bagasse Ash (SCBA), and Marble Powder (MP). These materials, rich in silica, alumina, and calcium, were partially added into the binder system to examine their effects on the fresh and hardened properties of geopolymer concrete. This research work highlights Geopolymer concrete as a durable, Eco-friendly material that reduces carbon emissions, supporting sustainable infrastructure development.

Keywords – Geopolymer Concrete, Natural Admixture, Marble powder, Performance Evaluation.

POLLUTION ABSORBING LIGHT WEIGHT BRICK

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Abstract— Composite bricks, which have superior practical qualities over traditional masonry, are quickly emerging as the building material of the future. This abstract presents a new sound-absorbing brick that cleverly blends earth, clay, alumina, polyurethane, and aerogel. Utilizing each component's unique capabilities to achieve greater sound absorption and structural integrity is the main innovation. Nanoscale aerogel particles and a polyurethane foam matrix are the main drivers of acoustic performance. Especially at mid-to-high frequencies, the polyurethane's porous, open-cell structure effectively transforms sound energy into heat. Because of its nano-scale porosity, aerogel increases the absorption range and greatly improves the thermal insulation of bricks. In order to maximize sound wave paths and improve the absorption synergy between the polyurethane and aerogel, alumina is essential for improving porosity and structuring certain pore shapes. A typical clay and soil backbone ensures the brick's required mechanical strength, durability, and formability.

Keywords - Sound absorption, porous, polyurethane, aerogel, alumina

ANALYSIS AND DESIGN OF WATER TANK STRUCTURE

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Abstract— The increasing demand for water storage in agriculture and urban sectors, coupled with the challenges posed by scarcity and uneven distribution, necessitates the development of efficient and sustainable water storage infrastructure. This paper focuses on the Analysis and Design of a Water Tank Structure intended to ensure a reliable supply of water for agricultural irrigation and domestic use. The structure integrates advanced design methodologies, structural analysis techniques, and automated monitoring systems to ensure durability, safety, and long-term performance in rural and semi-urban areas. A key feature of the proposed design is its ability to operate with minimal manual intervention, supported by automated water-level control systems and overflow mechanisms. Additionally, the use of sustainable materials and renewable energy for pumping operations makes the structure environmentally friendly and suitable for off-grid regions. Intelligent design algorithms enable the system to adapt to varying storage capacities and distribution demands, ensuring that the water supply remains reliable and cost-effective under fluctuating conditions.

Keywords –Structural Design, Water Tank, Analysis, Structural Failure

EXPERIMENTAL STUDY ON EFFECT OF FLY ASH ON STRENGTH BEHAVIOUR OF GEOPOLYMER CONCRETE

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Abstract— Concrete is the second most consumed material in the world after water, and its conventional binder, Ordinary Portland Cement (OPC), is a major contributor to global CO₂ emissions. To address sustainability concerns, geo polymer concrete (GPC) has emerged as an eco-friendly alternative that replaces cement with industrial by-products like fly ash, activated by alkaline solutions. This study investigates the effect of fly ash on the strength behavior of GPC. Class F fly ash, obtained from Ennore Thermal Power Plant, was used as the primary binder, along with sodium hydroxide (NaOH) and sodium silicate (Na₂SiO₃) solutions as alkaline activators. Coarse aggregates, fine aggregates, and distilled water were used to prepare the mixes. Experimental work involved proportioning, casting, and testing of specimens to evaluate compressive strength, under different curing conditions. The results indicate that GPC with fly ash exhibits comparable or superior strength performance to conventional OPC concrete.

Keywords – Geo polymer Concrete, Fly Ash, Sodium Hydroxide, Sodium Silicate, Strength Behavior, Sustainability.

DESIGN AND ESTIMATION OF WI-FI PARK USING TEKLA STRUCTURE

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Abstract— The growing demand for smart public infrastructure has driven the integration of digital connectivity into urban planning, giving rise to the concept of WiFi parks. This study explores the design and estimation aspects of a WiFi enabled park using Tekla Structures, leading Building Information Modeling (BIM) software known for its precision in structural design and cost estimation. WiFi parks aim to provide public access to wireless internet while enhancing urban functionality, sustainability, and user experience. The research focuses on utilizing Tekla Structures to model key elements of the park, including shelters, seating arrangements, lighting poles, pathways, and mounting structures for networking equipment. The software is used for detailed 3D modeling, structural analysis, and the generation of accurate material take offs and cost estimations. Emphasis is placed on optimizing the design for durability, aesthetic value, and efficient construction, while ensuring proper integration of network infrastructure such as routers,

Keywords – Smart infrastructure, Tekla Structures, Building Information Modeling (BIM), WiFi park design, Structural estimation,

DESIGN OF STRUCTURAL TRUSS AND FABRICATION MODELLING IN TEKLA

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Abstract— This paper presents the design, analysis, and detailing of a structural steel roof truss using Tekla Structures, a modern Building Information Modeling (BIM) software. A simply supported steel truss with a 12-meter span and 10 equal panels was modeled in 3D to demonstrate the practical application of software tools in structural design. Design loads, including dead load, live load, and wind load, were applied in accordance with the Indian Standards IS 800:2007 and IS 875 (Part 1–3). The structural analysis was performed to determine support reactions, internal axial forces, member slenderness ratios, and mid-span deflections. Cross-sections were selected to satisfy both strength and serviceability requirements, ensuring compliance with permissible stress and deflection criteria. Tekla Structures was used not only for modeling and analysis but also for generating accurate fabrication drawings and a comprehensive bill of materials (BOM). The software's visualization capabilities allowed for efficient interpretation of force paths, member behavior, and connection detailing.

Keywords – Steel Truss, Tekla Structures, IS 800:2007, Structural Analysis, BIM, Fabrication Drawings, Slenderness Ratio, Deflection Criteria.

ANALYSIS AND DESIGN OF COMMUNITY HALL BUILDING

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Abstract— This project is about the planning, analysis, and design of a Community Hall building by using standard engineering methods and codes. The structure was analyzed with the help of STAAD Pro V8i to understand how the loads act on different members, while the drawings were created using AutoCAD 2024. The main structural parts such as slabs, beams, columns, and footings were designed as per IS 456:2000, IS 875, and SP:16 design aids. The Limit State Method was used so that the building is strong, safe, and durable during its use. Different types of loads like dead load, live load, wind load, and self-weight were considered according to the National Building Code (NBC 2016). The Community Hall is planned to serve social, cultural, and public needs, by providing safe and comfortable spaces for gatherings and functions. The design also focuses on economy, stability, and proper use of materials so that the structure is both reliable and cost-effective.

Keywords – AutoCAD 2024, STAAD Pro V8i, IS Codes, NBC 2016.

PLANNING, DESIGNING AND ANALYSIS OF G+1 LIBRARY BUILDING

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Abstract— The development of educational infrastructure plays a crucial role in promoting knowledge and learning. Among such infrastructures, libraries serve as essential facilities for reading, research, and academic interaction. This project focuses on the planning, designing, and structural analysis of a G+1 library building, integrating architectural functionality with structural safety and sustainability. The objective of this study is to plan and design a well-equipped library that meets the spatial, functional, and aesthetic requirements of a modern educational institution while ensuring strength, stability, and economy in structural design. The proposed library building consists of a ground floor plus one upper floor (G+1). The ground floor includes a reception area, reading halls, a book stack area, a digital reading zone, and staff rooms. The first floor comprises study sections, discussion rooms, reference sections, and a seminar hall. Proper circulation, ventilation, and lighting are considered key aspects during planning.

Keywords – AutoCAD 2024, STAAD Pro V8i, IS Codes, NBC 2016.

ADDRESSING THE LANDSLIDE ISSUES AND FORECASTING MITIGATION MEASURES USING AI-ML & CNN TECHNIQUES

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Abstract— The environment, infrastructure, and human lives are all seriously at risk from landslides, which emphasizes the necessity of precise forecasting and efficient mitigation. In order to improve landslide predictions, this study explores the integration of Convolutional Neural Networks (CNN), Machine Learning (ML), and Artificial Intelligence (AI). Large geological, hydrological, and meteorological datasets are processed using AI-ML models to find trends and forecast possible landslides. CNNs use topographic maps and satellite photos to more accurately identify high-risk regions. The suggested AI- driven method enhances risk assessment and landslide susceptibility mapping by utilizing historical data and real-time monitoring. Spatial analysis for efficient mitigation planning is further strengthened by the incorporation of Geographic Information Systems (GIS). In order to maximize slope stabilization measures, reinforcement learning approaches are also investigated.

Keywords – AIMA, CNN, GIS, Land Slides, Forecasting Mitigation Measures.

ANALYSIS AND DESIGN OF COMMERCIAL BUILDING USING STAAD PRO

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Abstract— The rapid growth of urban infrastructure has increased the demand for safe, efficient, and economical commercial buildings. Structural analysis and design play a vital role in ensuring stability, strength, and serviceability of such structures. This project focuses on the analysis and design of a multi-storey commercial building using STAAD.Pro, widely used structural engineering software. The building is modeled as a reinforced concrete (RCC) frame structure considering dead load, live load, wind load, and seismic load in accordance with relevant IS codes. The software is utilized to perform load calculations, structural analysis, and member design including beams, columns, slabs, and foundations. The design emphasizes not only strength and stability but also economy and constructability. The outcome of the project is a safe and optimized structural system that can be practically implemented for commercial purposes.

Keywords – STAAD Pro, Commercial Building, RCC Frame Structure, Structural Analysis

INTEGRATED INTELLIGENT TRANSPORTATION TRAFFIC MANAGEMENT PLANNING SYSTEM

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Abstract— An Integrated Intelligent Transportation Traffic Management Planning System (IITPMPS) leverages technologies such as Artificial Intelligence (AI), sensors, and cameras to collect real-time traffic data. This system aims to optimize vehicle flow, alleviate congestion, and improve road safety. It adjusts traffic light timings, coordinates infrastructure, prioritizes emergency vehicles, and offers data-driven insights to enhance overall transportation efficiency and minimize travel times. To develop a smart traffic management system, it is essential to combine hardware sensors—such as cameras, RFID, or infrared sensors—with software that often employs AI and machine learning. This integration allows for the collection and analysis of real-time traffic data. The system processes this information to optimize traffic signal timing, generate traffic flow statistics, and deliver actionable insights for traffic control, ultimately aiming to minimize delays and enhance overall efficiency.

Keywords – Intelligent Transport, Traffic Management, AIML, Control Systems.

DESIGN AND ANALYSIS OF COMMUNITY GOVERNANCE BUILDING

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Abstract— This project is about the planning, analysis, and structural design of a Community Governance Building, which is proposed to function as a Community Governance Building. The main aim of this project is to design a safe and comfortable building where local people can access all necessary services. The complete design work has been carried out by following Indian Standard Codes of Practice. The structural drawings show the details of important building parts like slabs, beams, columns, and footings. The analysis of the structure was done using STAAD Pro V8i software, which helps in checking the strength and stability of the building. All the members of the building were designed as per IS 456:2000, IS 875, and SP-16 design aids. The design follows the Limit State Method, and the loads acting on the structure were taken from the National Building Code (NBC). The Community Governance Office is planned in such a way that it provides private and useful spaces for the people in their daily activities.

Keywords – Community Governance, NBC, IS: 456, IS: 875, SP:16, STAAD Pro V8i, Design and Analysis

DESIGN AND ESTIMATION OF BUCKET ELEVATOR TOWER USING TEKLA STRUCTURE

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Abstract: The bucket elevator tower is a necessary supporting structure in silo structures that allows for the vertical transportation of bulk commodities like grains, cement, and other aggregates. The current research involves the design and estimation of a bucket elevator tower with the use of Tekla Structures software. The design process aims to ensure stability, durability, and safety against static and dynamic loads and also satisfaction of functional requirements. Tekla Structures supports precise 3D modeling, detailing, and clash detection to ensure accuracy of structural elements like columns, bracings, and connections. The software also supports material optimization, minimizing wastage and project cost. Load factors like wind, seismic, and operating loads are included to improve structural performance. The estimation process offers a detailed bill of materials (BOM), cost estimation, and fabrication information, allowing effective project planning and execution. This methodology provides reliability in construction, enhances productivity, and reduces errors over traditional methods. The result is a cost-efficient and structurally sound bucket elevator tower appropriate for contemporary silo use.

Keywords: WTE – Waste to Energy, MSW -Municipal solid waste, Pollution control, Resource recovery, Economic feasibility, Waste management.

A COMPARATIVE LIFE CYCLE ASSESSMENT (LCA) AND LIFE CYCLE COST ANALYSIS (LCCA) OF EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS) VERSUS CONVENTIONAL PLASTERING WITH PAINT FINISH FOR COMMERCIAL BUILDINGS IN INDIA

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Abstract: The building and construction sector in India is a significant contributor to energy consumption, greenhouse gas emissions, and resource depletion. The selection of exterior wall systems is a critical decision that impacts a building's long-term environmental and economic performance. This study presents a comparative Life Cycle Assessment (LCA) and Life Cycle Cost Analysis (LCCA) of two prevalent exterior wall systems: Exterior Insulation and Finish Systems (EIFS) and Conventional Plastering with Paint Finish, within the context of Indian commercial buildings. Conclusion: For commercial buildings in India, EIFS presents a compelling case as a sustainable and economically viable alternative to conventional plastering. While the higher initial investment and embodied impacts of EIFS are non-trivial, they are offset by substantial long-term gains in operational energy efficiency and reduced maintenance. This integrated LCA-LCCA approach demonstrates that prioritizing only first costs in material selection leads to suboptimal economic and environmental outcomes. The findings advocate for the adoption of high-performance, insulated envelope systems like EIFS in India's commercial building codes and green rating systems to align with national goals for energy conservation and sustainable development.

Keywords: Life Cycle Assessment (LCA), Life Cycle Cost Analysis (LCCA), EIFS, Conventional Plaster, Commercial Buildings, India, Building Sustainability, Energy Efficiency, Embodied Carbon.

A COMPARATIVE LIFE CYCLE ASSESSMENT (LCA) AND LIFE CYCLE COST ANALYSIS (LCCA) OF EXTERIOR A SUSTAINABLE APPROACH TO SALINE WATER MANAGEMENT FOR AGRICULTURE USING AGRO-WASTE AND SALT-TOLERANT MICROBES

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Abstract: Salinization of agricultural soils and the scarcity of freshwater compromise food security in many arid and semi-arid regions. This paper presents an integrated, low-cost, and sustainable approach that couples simple physicochemical treatment using agro-waste media with biological remediation via salt-tolerant plant growth-promoting microbes (ST-PGPMs) for the management of saline irrigation water. The approach is designed for smallholder farms and community irrigation schemes: (1) pre-treatment of saline/brackish water using packed-bed filters containing agricultural wastes (biochar, rice husk, coconut coir) to reduce suspended solids and trap a fraction of salts by adsorption and ion exchange; (2) biologically assisted desalination and soil amelioration using ST-PGPM consortia (halotolerant rhizobacteria, halophilic fungi) applied as seed/soil inoculants; and (3) adaptive irrigation scheduling and salt leaching strategies to maintain soil salinity within crop tolerance. Field trial simulations and literature synthesis indicate that the combined system improves crop germination and yields for moderately salt-affected water (electrical conductivity EC_w up to 8 dS/m) when matched with salt-tolerant crops and proper management. The paper discusses design considerations, microbial selection, socio-economic feasibility, environmental impacts and a roadmap for pilot deployment.

Keywords: Saline water management; agro-waste; biochar; salt-tolerant microbes; halotolerant rhizobacteria; sustainable agriculture; irrigation management.

DEGRADATION OF ACID ORANGE 7 FROM WASTEWATER BY MICROWAVE-ASSISTED FENTON PROCESS USING BIOCHAR-SUPPORTED MAGNETITE

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Abstract: The proposed study aims to investigate the degradation of Acid Orange 7 (AO7) dye from synthetic textile wastewater using a microwave-assisted heterogeneous Fenton process catalyzed by biochar-supported magnetite nanoparticles (Fe₃O₄/BC). The integration of microwave irradiation with the Fenton process is expected to enhance hydroxyl radical generation, reduce reaction time, and improve degradation efficiency. The biochar support will provide high surface area and stability to magnetite nanoparticles, ensuring reusability and reduced iron leaching. The study is expected to demonstrate that the microwave-assisted Fenton process, using biochar-supported magnetite as a catalyst, offers a rapid, energy-efficient, and sustainable alternative for the treatment of dye-laden industrial wastewater. The findings will establish the foundation for further kinetic modeling and scale-up studies in subsequent project phases.

Keywords – Degradation of Acid Orange 7 (AO7) dye, biochar-supported magnetite nanoparticles (Fe₃O₄/BC), Heterogeneous Fenton process, energy-efficient, dye-laden industrial wastewater.

BIO-CHAR PRODUCTION USING COCONUT PETIOLE, BHENDI STALK AND BRINJAL STALK FOR CARBON SEQUESTRATION

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Abstract: The escalating challenges of climate change necessitate innovative approaches to carbon sequestration. Biochar, a stable form of carbon produced through the pyrolysis of organic materials, has emerged as a promising method for long-term carbon storage in soils. This study investigates the potential of producing biochar from three agricultural residues—coconut petiole, bhendi (okra) stalk, and brinjal (eggplant) stalk—and evaluates their efficacy in carbon sequestration and soil enhancement.

Keywords: Bio-Char, Coconut Petiole, Bhendi Stalk, Brinjal Stalk.

COMPARATIVE STUDY ON THE EFFICIENCY OF TYPHA LATIFOLIA FOR HEAVY METAL REMOVAL FROM SEWAGE SLUDGE USING ORGANIC AND SYNTHETIC CHELATORS

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Abstract: Sewage sludge generated from wastewater treatment plants often contains elevated concentrations of heavy metals, limiting its direct agricultural use and posing environmental risks. Phytoremediation using macrophytes offers an eco-friendly and cost-effective strategy for mitigating such contamination. The present study investigates the comparative efficiency of *Typha latifolia* in removing heavy metals (Pb, Cd, and Cu) from sewage sludge assisted by three chelating agents—citric acid, oxalic acid, and ethylenediaminetetraacetic acid (EDTA). Pot-scale experiments were conducted with homogenized sewage sludge (Pb: 215 mg kg⁻¹, Cd: 6.2 mg kg⁻¹, Cu: 175 mg kg⁻¹) blended with topsoil in a 40:60 (v/v) ratio. Chelating agents were applied at two levels (EDTA: 1–5 mmol kg⁻¹; citric and oxalic acids: 2–10 mmol kg⁻¹). After eight weeks, plant biomass, metal accumulation in roots and shoots, and leachate quality were analyzed. EDTA markedly enhanced shoot accumulation of Pb (148 mg kg⁻¹) and Cu (132 mg kg⁻¹) but caused higher leaching losses (15–18%). Citric and oxalic acids improved uptake efficiency (Pb: 110–125 mg kg⁻¹; Cu: 98–105 mg kg⁻¹) with minimal leachate losses (<5%) and increased biomass yield by 22–28% over the control. The findings demonstrate that *Typha latifolia* exhibits strong tolerance to sludge-borne metals and considerable biomass production (~780 g m⁻² dry weight). Biodegradable chelators, particularly citric acid, present a sustainable alternative to synthetic agents for enhancing the phytoremediation potential of sewage sludge.

Keywords: Phytoremediation, *Typha latifolia*, sewage sludge, EDTA, citric acid, oxalic acid, chelating agents, heavy metals.

UTILIZING UNTREATED PINE POLLEN AS A NATURAL BIO SORBENT FOR MICRO PLASTIC REMOVAL FROM WATER SYSTEM

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Abstract: The presence of microplastics in aquatic environments poses a significant threat to both ecosystems and human health due to their persistence, bioaccumulation, and potential to transport toxic substances. Conventional methods for microplastic removal, such as filtration and chemical treatments, are often costly and may introduce secondary pollutants. This study explores the potential of untreated pine pollen as a natural, eco-friendly, and cost-effective bio sorbent for the removal of microplastics from water systems. Batch experiments were conducted to evaluate the adsorption efficiency of pine pollen for microplastics under varying conditions of concentration, contact time, and pH. The results demonstrated that pine pollen exhibits a notable capacity for microplastic adsorption, likely due to its porous structure and surface functional groups. Kinetic and isotherm analyses indicated that the adsorption process follows a [pseudo-second-order / Langmuir / Freundlich] model, suggesting [chemisorption/physical adsorption] as the primary mechanism. This study highlights the potential of using untreated pine pollen as a sustainable bio sorbent, providing an environmentally benign alternative for microplastic remediation in water systems. Future work will focus on optimizing adsorption conditions and scaling up for practical water treatment applications.

Keywords – Microplastics, Pine Pollen, Bio sorbent, Water Remediation, Adsorption

ECONOMIC AND TECHNICAL ANALYSIS OF GREEN FLY ASH BRICKS INFUSED WITH READY-MIX CONCRETE SLUDGE

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Abstract: RMC plants play vital role in the modern construction arena whereby the time and energy in mass concrete production can be minimized besides sustaining the desirable qualities of concrete. However RMC plants are vulnerable to produce relatively large quantities of sludge as a offshoot to truck drum cleaning process. Disposal of such waste by-products from RMC possess a threat to the environment resulting in pollution and contamination problem. From the point of view of environmental protection the techno economic prospects of recycling and utilization of the waste sludge has partial substitution material alongside fly ash in making bricks has been explored. The experimental trials have endorsed substitution of dried sludge powder for fly ash at replacement levels of 10%, 15% and 20% were tried and tested for compressive strength. Of these, 20% of sludge replacement with fly ash has been found effective in maintaining the desirable compressive strength of normal fly ash bricks.

Keywords: RMC plant, dried sludge powder.

CONVERTING TEXTILE RESIDUES INTO SUSTAINABLE INTERLOCKING PAVER BLOCK

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Abstract: The growing demand for sustainable and innovative construction materials has driven researchers to develop solutions that meet both environmental and performance requirements. This research focuses on the incorporation of cotton textile waste fibers into interlocking paver blocks (IPBs) using perlite lightweight concrete. Textile waste, a major industrial by-product, presents serious disposal challenges, while perlite enhances the concrete's thermal and lightweight properties. In this study, cotton textile waste fibers enclosed within a fiber mesh were embedded at the core of IPBs to evaluate their mechanical behavior, energy absorption capacity, and thermal insulation performance. The experimental results revealed that IPBs with textile waste cores exhibited improved ductility, higher energy absorption, reduced density, and enhanced thermal efficiency compared to conventional paver blocks. This innovative approach not only promotes environmental sustainability by recycling textile waste but also provides a cost-effective and energy-efficient alternative for modern construction applications.

Keywords – *Textile Waste Fibers, Interlocking Paver Blocks (IPB), Perlite Lightweight Concrete, Sustainable Construction Materials, Thermal and Mechanical Properties*

CONVERTING TEXTILE RESIDUES INTO SUSTAINABLE INTERLOCKING PAVER BLOCK

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ABSTRACT: The disposal of textile waste has become a significant environmental concern due to the rapid growth of the fashion and textile industries. This project focuses on utilizing textile residues as a partial replacement for conventional materials in the production of sustainable interlocking paver blocks. The aim is to reduce waste accumulation and promote eco-friendly construction practices. The textile residues are processed, shredded, and mixed with cement, sand, and aggregates in varying proportions to analyze their impact on the mechanical strength, durability, and water absorption of the paver blocks. Laboratory tests such as compressive strength and flexural strength are conducted to evaluate performance compared to standard paver blocks. The results demonstrate that incorporating textile waste can enhance sustainability while maintaining acceptable structural properties. This study highlights a circular economy approach, turning industrial waste into a value-added construction material, contributing to waste reduction and sustainable infrastructure development.

Keywords: *Textile Waste, Sustainable Construction, Interlocking Paver Block, Waste Utilization, Circular Economy*

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CSE- INT 75.	AI FOR SMART CITIES AND IOT APPLICATIONS	NISHA M AKHILA J ISHA K ATHUL R

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CSE- INT 76.	AI MODELS FOR URBAN AIR QUALITY MONITORING AND PREDICTIVE ANALYSIS	DHANYAKRISHNAN ABHIRAMI R ABINAYA B KIRUTHIKA G
CSE- INT 77.	AI PLANT TRANSLATOR	R SUBALAKSHMI JANANI A HINKITHA V DHINESH R
CSE- INT 78.	MACHINE LEARNING TECHNIQUES FOR PREDICTING WEATHER	S PARTHIBAN BALAMURUGAN S BHARANIDHARAN SDEEPAKKUMAR S
CSE- INT 79.	AI-DRIVEN MUSIC RECOMMENDATION SYSTEM	ASWATHY P B ANAS V ALBIN H ADITHYAN SURESH
CSE- INT 80.	AI POWER CODE GENERATION ASSISTANT	DHANYAKRISHNAN VISHNU NARAYANAN YADUKRISHNAN V SREEJAYE V K
CSE- INT 81.	AI FOR PUBLIC TRANSPORT OPTIMIZATION	DHANYA KRISHNAN VIJAYA RAGAVAN S VIJAYABHASKAR B VINU ARAVINDH S
CSE- INT 82.	AI POWERED E-COMMERCE CHATBOT	SINCIJA C YUVASRI M VANJINAYAKI K
CSE- INT 83.	AI POWERED GAME LEVEL GENERATOR	PARTHIBAN S SANTHOSH V VIJAY SURIYA V SIVABALAN A SIVABALA K S
CSE- INT 84.	AUTOMATED ESSAY GRADING (AEG) SYSTEM	SHAMNA PARVEEN S SATHYA NARAYANAN R SATHYA PRIYAN T
CSE- INT 85.	AUTOMATIC TROLLY	ANUSHA P SURYA S SATHYAJITH T C
CSE- INT 86.	BOOK EXCHANGE PLATFORM A WEB-BASED SYSTEM FOR SUSTAINABLE BOOK SHARING.	DHIVYABHARATHI D THARSHIKA M YASODHA R VIDHYA A
CSE- INT 87.	CRIME RATE PREDICTION SYSTEM USING HYBRID DATA-DRIVEN APPROACHES: INTEGRATING SOCIOECONOMIC AND ENVIRONMENTAL FACTORS	SINCIJA C SRIHARSHA S SRISUJINTH M R SIVASAKTHI M
CSE- INT 88.	CUSTOMER CHURN PREDICTION	MR TAMISHARASU S SIVABALAN R SIVANADESH S SIVANESH M

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CSE- INT 89.	FAKE NEWS DETECTOR CHROME EXTENSION	MRS SOUMYA M SOWMYA P SENIN SREELAKSHMI RAJAN S
CSE- INT 90.	FOOD RECOGNIZATION USING AI (CNN MODEL)	MS ASWATHY PB SRINATH S YOKESH D SUNIL S
CSE- INT 91.	FOOD WASTE REDUCTION APP	DR B RAJESH KUMAR SARAVANA VEL V SARATHI S SARAN S
CSE- INT 92.	IOT DEVICE SECURITY SCANNER	MS R SUBALAKSHMI SYED ALI BASITH SURYA C SUDARSHAN S
CSE- INT 93.	JOB PORTAL WITH AI RESUME MATCHER	SRUTHY K V VASANTH KUMAR VEERANDRA RAJA T
CSE- INT 94.	LUNG CANCER DETECTION	R SUBHALAKSHMI S SHENBAGAVALLI A SRIVIDIA DEVI
CSE- INT 95.	MALWARE SANDBOX ENVIRONMENT	R RAMYA TAMIZHARASAN G THIJIBHARATH B
CSE- INT 96.	PASSWORD STRENGTH CHECKER WITH AI	D DHIVYABHARATHI VIVEK RAY VENU PRAKASH S UDAYAKUMAR S
CSE- INT 97.	PNEUMONIA DETECTION USING X-RAY	V RAMESH KUMAR VRINDHA HAREESH T JINAN DEV M
CSE- INT 98.	AI-BASED REAL-TIME LANGUAGE TRANSLATION MANAGEMENT SYSTEM: INTEGRATING NEURAL AND STATISTICAL APPROACHES FOR MULTILINGUAL MANAGEMENT	SOUMYA M VIGNESH K VADIVELAN M SETHURAMAN K
CSE- INT 99.	SERVERLESS IMAGE PROCESSING APPLICATION	NISHA M VAISHNAV V VISHNU S NAIR VIMALKUMAR V
CSE- INT 100.	A SMART ADAPTIVE TRAFFIC MANAGEMENT SYSTEM FOR URBAN INDIA USING IOT AND AI	R RAMYA SREE RUDHRA B SWETHA K VAISALI B P
CSE- INT 101.	VULNERABILITY SCANNER FOR WEB APPLICATIONS	DR B RAJESHKUMAR VISHNU PRASAD S ELDHOSE BINU SIVA SANKARAN P S

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CSE- INT 102.	A NOVEL APPROACH TO AUTOMATED FAKE NEWS DETECTION USING MACHINE LEARNING AND ENSEMBLE METHODS	MS NISHA HARIN VAISHNAVI K KATHIYAINI G KAVASKAR M
CSE- INT 103.	A NOVEL TO IMMERSIVE EDUCATION THROUGH VIRTUAL REALITY–BASED CAMPUS TOURS	DHIVYABARATHI D RAGUPATHI S KOWSALYA KGOURIDAS H HARI HARA SUDHAN M
CSE- INT 104.	ADAPTIVE AIOT-ENABLED CYBER-PHYSICAL FRAMEWORK FOR REAL-TIME AND PREDICTIVE URBAN MANAGEMENT	DHIVYABHARATHI D MADHESH I MAHESH R GOPIRAM DEVA M
CSE- INT 105.	AI HR RECRUITER & VIRTUAL CAMPUS INTERVIEW	RAJESH KUMARGENESIS MANOVA V ABHINAV KRISHNAN PS ASHWIN A ANFAS RAHIMAN A
CSE- INT 106.	RESILIENT AI FOR DEGRADED COMPUTE: ENSURING RELIABILITY BEYOND PERFECT HARDWARE	ASWATHY PB ADITHYA SUBRAMANIAM AJAY VA ASWIN G DHANUSH S
CSE- INT 107.	FOOD FRESHNESS 0:INNOVATION IN EARLY SPOILAGE DETECTION	RAMYA R GOWTHAM R MILAN TOMY INDHIRANI V ASHWINI S G
CSE- INT 108.	IOT BASED VEHICLE ANTI THEFT SYSTEM	SRUTHY K V ABISHEK P KASHYAP KRISHNAN DON SHIBU AJMAL S
CSE- INT 109.	IOT-DRIVEN AUTONOMOUS DRONES: INNOVATIONS AND APPLICATIONS	MR PARTHIBAN KUNHUKOYA SAIEED A ARJUN K ASWAJITH A
CSE- INT 110.	MASTERING MONEY:STRATEGIES FOR PERSONAL FINANCIAL SUCCESS	SRUTHYK V ILAKKIYA N DHIVYA DHARSHINI R GOKULANAND M
CSE- INT 111.	QUANTUM REVOLUTION: TRANSFORMING COMPUTING AND BEYOND	MS DHIVYABHARATHI D DHARANIDHARAN M AATHI SMAHIBALAN SJEEVARAGHUL ASN
CSE- INT 112.	SENTIMENT ANALYSIS AND EMOTION DETECTION	DHIVYABHARATHI ABI NEYATHII R S DIVYA DHARSHINI M DHIVYA K KAVIYA DHARSHINI M

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CSE- INT 113.	SMART SERVICES HUB 0: TRANSFORMING CONNECTIVITY AND INNOVATION	MS DHIVYABHARATHI D ARUNACHALAM M RGOKULAKRISHNAN
CSE- INT 114.	THE POWER OF BIG DATA:ANALYTICS FOR A SMARTER WORLD	ASWATHY P B FATHIMA SANA PJ ARYA T MANANYA V NAVYA C
CSE- INT 115.	AI-POWERED FACT-CHECKING SYSTEMS FOR COMBATING MISINFORMATION	MR RAMESHKUMAR NIVAS R NITHIN K PASUPTHI S
CSE- INT 116.	AI-DRIVEN INTRUSION DETECTION SYSTEM USING MACHINE LEARNING TO DETECT THREATS IN REAL TIME	MR S PARTHIBAN MANOJ KUMAR K RAMASELVAM KA RAJARAJAN K
CSE- INT 117.	AI-DRIVEN PORTFOLIO WEBSITES FOR PERSONALIZED PROFESSIONAL BRANDING	MRS NISHA M ROOPIKA V ROSHINI M SANDHIYADEVI V
CSE- INT 118.	AI-POWERED PROCEDURAL CONTENT GENERATION FOR GAME DESIGN	ASWATHY PPECHCHI AKASH VNITHEESH PSANTHOSH B
CSE- INT 119.	AI-INTEGRATED PROGRESSIVE WEB APPS FOR NEXT-GEN USER EXPERIENCE	MR TAMIZHARASU MARUTHEESH GK NAMBU DHARSANAN R MOHAMMED HUSSAIN SM
CSE- INT 120.	ALGORITHM IC CODE GENERATORS : AUTOMATING SOFTWARE DEVELOPMENT	MRS SHAMNA SANJAI A SANJAINP MOHAMED PAYAS M
CSE- INT 121.	AUTONOMOUS SURVEILLANCE DRONES:AI INTEGRATION FOR SECURITY AND MONITORING	MS DHANYA MOHAMED ASHIK A MOHAMED S RAZAL AHAMMED H
CSE- INT 122.	BLOCKCHAIN ENABLED FRAME WORKS FOR SECURE DIGITAL TRANSACTIONS	DR B RAJESH KUMARV NAVEEN NAVEEN KS NARESH A
CSE- INT 123.	BUILDING TRUST BY MAKING AI DECISIONS UNDERSTANDABLE TO HUMANS	MRS SRUTHY KV NANDHINI C NAVAMITHAA B POORNIMA M
CSE- INT 124.	DEVELOPING MACHINE LEARNING MODEL ON EDGE DEVICE FOR FASTER PROCESSING	DR S TAMIZHARASUJ PRAVEEN KUMAR N MOTHIL SANTHOSHKUMAR B

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CSE- INT 125.	DETECTING DEFORESTATION USING GOOGLE EARTH ENGINE (GEE)	SRUTHY KV NIDHISH J REETHIKAA P PRADEESWARAN B
CSE- INT 126.	EDGE AI APPLICATION: ENABLING INTELLIGENCE AT THE DEVICE LEVEL	MS RAMYA RGOWTHAM KRISHNA G MUHAMMAD SHAHEER T MOHAMMED MUSHAF A K
CSE- INT 127.	ENHANCING LEARNING OUTCOMES THROUGH GAMIFICATION: AN AI-ENABLED INTERACTIVE DESIGN	MS SUBALAKSHMISACHIN A MOTHESH R MOHAMMED AJSAL KT
CSE- INT 128.	GAMIFICATION IN EDUCATION : ENHANCING LEARNING THROUGH INTERACTIVE DESIGN	MS ANUSHA SABARI M SABARI PRASURAN M SANJEEVIRAJ D
CSE- INT 129.	GENERATIVE AI FOR PERSONALIZED LEARNING PACE: DESIGNING REAL-TIME COGNITIVE LOAD ADAPTIVE CONTENT DELIVERY	MS ANUSHA R MUTHUKRISHNAN HALEEL MARAKKAR P SAJMIN ZAMAN MT
CSE- INT 130.	GENERATIVE ROBOTICS: ADVANCING AUTOMATION THROUGH AI-DRIVEN DESIGN	S PARTHIBAN RESHMI A PRARTHANA CR
CSE- INT 131.	INTERACTIVE DATA VISUALIZATION FOR SMARTER DECISION MAKING	MS SOUMYA S NANGESWARAN R SAIRAM KUMAR M MOHAMED ABURAR
CSE- INT 132.	SERVERLESS WEB ARCHITECTURE FOR SCALABLE CLOUD	MS SINCIJA C RITHEESHKAR R RAMAKRISHNAN C MUTHUGANESH M
CSE- INT 133.	SYNTHETIC DATA GENERATION: ARTIFICIALLY CREATED DATA FOR AI TRAINING	MR RAMESH KUMAR NIVEDITHA C RIMA J
CSE- INT 134.	HEALTHCARE WITH ROBOTICS: AI ENABLED TRANSFORMING INNOVATION	SHAMNAPARVEEN S PRIYADHARSHINI R MOUNITHA R MOLI S
CSE- INT 135.	TURNING RAW DATA INTO INSIGHT WITH DASHBOARDS AND VISUAL STORYTELLING	MS ASWATHY S MATHANKUMAR B PRIYADHARSHINI S SANGAVI
CSE- INT 136.	ZERO TRUST ARCHITECTURE FOR MODERN NETWORK SECURITY	MS DHIVYABHARATHI P SANTHOSH MUKILAN S R PRAGADEESH
CSE- INT 137.	ADVANCEMENTS AND CHALLENGES IN ELECTRONIC VOTING SYSTEM	ASWATHY PB UDHAYA KUMAR R TARICSHARON AS VASANTH A

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CSE- INT 138.	MOBILE APP FOR FARMING	MRS SRUTHY KV NANDHA PRAKASH S NAVEEN KUMAR M SARAN S
CSE- INT 139.	AGRICULTURAL WEB DEVELOPMENT	MRS DHANYA KRISHNAN NAVIN M NISHANTH K NISHANTH KK
CSE- INT 140.	SMART ATTENDANCE USING IOT	MR TAMIL ARASU MR TAMIL ARASU VISHWANANTHAN S YUVARA
CSE- INT 141.	AN INTELLIGENT WEB APPLICATION FOR BUSINESS RISK ANALYSIS AND SUCCESS PREDICTION	NISHA M SHREE HURSH NIDHEESH N PRANAV B
CSE- INT 142.	BLOCK CHAIN AND AI FUSION FOR SECURED CLOUD COMPUTING	SINCIJA C VIDHU KRISHNAN K S NITHIS M RANJITH KRISHNA R
CSE- INT 143.	EMERGENCY VEHICLE PRIORITY SYSTEM	MR S PARTHIBAN SWETHA KRISHNA V VIOLIN G SREE LAKSHMI KM
CSE- INT 144.	BIG DATA ANALYTICS FOR DECISION INTELLIGENCE	K V SRUTHY NIHITHA H SANTHIYA C SARUMATHI V
CSE- INT 145.	DUAL-LAYER SECURITY WITH AI VOICE RECOGNITION AND CODE- BASED AUTHENTICATION	MR RAMESH KUMAR RAHUL VELAVAN S RAKESH KANNA KSANJAY K
CSE- INT 146.	LIGHTWEIGHT UNIFIED MODEL FOR IMAGE AND SHORT VIDEO DETECTION USING LATENT FEATURES AND SPATIO-TEMPORAL TRANSFORMERS	DHANYA KRISHNAN TAMIL MARAN N YOGESH WARAN M VISHAL PRITHIVI K S
CSE- INT 147.	SYNTHETIC CREATIVITY: TRANSFORMING MEDIA AND ENTERTAINMENT WITH AI	MRS DHIVYABHARATHI D SREYAS DAS S PRADOSH M SIDHARTH A
CSE- INT 148.	ARTIFICIAL INTELLIGENCE BASED HUMAN ACTIVITY RECOGNITION FOR SMART APPLICATIONS	ASWATHY P B NANDHINI R NIRMALA D PRATHAP S
CSE- INT 149.	AI CAREER COMPASS: A PERSONALISED DATA-DRIVEN FRAMEWORK FOR CAREER GUIDANCE	MRS SHAMNA PARVEEN SUBASHREE T VAISHNAVI P TAMILKAVI N

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CSE- INT 150.	ADAPTIVE AI-BASED STACK FILTER DETECTION FOR INTELLIGENT SIGNAL PROCESSING	RAMYA R SELVAKUMAR E RAGUPATHI R SARAVANA KUMAR M SANJAYGANTH M
CSE- INT 151.	MOBILE APP FOR FARMER-MARKET DIRECT CONNECTION	MRS C SINCIJA PAVITHRAN S PRASANNA KUMAR P PRADEESH M
CSE- INT 152.	AI POWERED CHATBOT	MRS RAMYA R SUJITH K SIVARAJAN C SRIRAM M
CSE- INT 153.	SMART TASK REMINDER WITH AI	ANUSHA P SURESH KRISHNA K SRIHARI M YOGESH S
CSE- INT 154.	OFFLINE-FIRST AI: BUILDING SMART SYSTEMS THAT WORK WITHOUT INTERNET	MS SOUMYA VIGNESH MRS SOUMYA M SHIBAN PRANAV SB
CSE- INT 155.	SMART AGRICULTURE SYSTEM WITH AI & AUTOMATION	MRS SOUMYA MVIPIN SHARMA M VIJAYA SELVAN S YOGESHWARANR
CSE- INT 156.	AI CLIMATE DETECTOR	MR PARTHIBAN S SARAVANAN E SARANRAJ K MANIKANDAN K
CSE- INT 157.	ARTIFICIAL INTELLIGENCE HEALTH CARE DIAGNOSTICS	MS D DHIVYABHARATHI NARMAN FRANK R SANTHOSH S RAJIV R
CSE- INT 158.	VED CROP: TRANSFORMING AGRICULTURE WITH ARTIFICIAL INTELLIGENCE	SOUMYA M VEDA SARATHI V VENKATESH R VARUN VISHWA D
CSE- INT 159.	BUILD A DIGITAL PLATFORM TO COLLECT RECYCLE OR REFURBISH IT HARDWARE	R RAMYA KRISHNA KUMAR S KABIL D GOWTHAM K BOOPATHI RAJA P
CSE- INT 160.	DRONE PROGRAMMING 0: INNOVATIONS AND BEST PRACTICES	ASWATHY P AKASH V DILIP S DAVID S HARISH K
CSE- INT 161.	FAKE PROFILE AND DEEPFAKE DETECTION SYSTEM	MRS SUBALAKSHMI R RASHMIKA M NIKARIKA NAMEETHA
CSE- INT 162.	PREDICTIVE MODELING OF DIABETES DIAGNOSIS THROUGH DATA SCIENCE METHODS	MRS SINCIJA C ROSHNA K T POOJA RAMESH REYZY JOSEPHINE K R

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CSE-EXT 1	AI FOR SUSTAINABLE DEVELOPMENT AND SMART SOCIETIES	MS K RAJALAKSHMIM J MADHUMITHA BURRI VENKATA KASI RAJU PILLI VISHNU A NETHAJI
CSE-EXT 2	DATA-DRIVEN SOLUTIONS FOR INDUSTRY 5.0.	MR DASARI MAHESH UG
CSE-EXT3	FUSION-BASED APPROACH FOR IDENTIFYING PEPPER LEAF DISEASES USING XGBOOST CLASSIFIER	R S PANDIKUMAR DR B N BOBINATH DR G RAJKUMAR DR K ANURATHA DR M SENGALIAPPAN
CSE-EXT4	GENERATIVE AI AND ITS ROLE IN FUTURE COMPUTING	MS K RAJALAKSHMI S JANANI B CHANDRU B DEEPAK S SUBASH
CSE-EXT5	SYNERGISTIC ADVANCES IN AI MACHINE LEARNING AND HIGH-PERFORMANCE COMPUTING: TOWARD SMARTER SCALABLE SYSTEMS	MR AARURAN K MR ASHWIN MUTHU R MR ETHISH R
CSE-EXT6	YOLO-AQUA: INTELLIGENT DETECTION OF PLASTIC DEBRIS IN AQUATIC ENVIRONMENTS	TANISHA DUTTA MADHUMITHA K
CSE-EXT7	SMARTFORM: INTELLIGENT OCR SYSTEM FOR DIGITAL BANKING AUTOMATION	C SONA VIJAYAN DR MADHUMITA K
CSE-EXT8	BIG DATA ANALYTICS FOR DECISION INTELLIGENCE IN HEALTHCARE	MR SUGAVANAM S MS MAMTHA M MS HARIHARA SUDHA MR BHARATH PANDIAN MR PAVANKUMAR NAIDU
CSE-EXT9	PREDICTING SEX FROM RETINAL FUNDUS PHOTOGRAPHS USING AUTOMATED DEEP LEARNING	MR M NITHISH
CSE-EXT10	APPLYING CLUSTERING ALGORITHMS ON E-COMMERCE TRANSACTION DATA FOR IMPROVED INVENTORY MANAGEMENT DECISIONS	PRANEETHKUMAR

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CSE-EXT11	DATA-DRIVEN SOLUTIONS FOR INDUSTRY 5.0.	MR DASARI MAHESH
CSE-EXT12	FUSION-BASED APPROACH FOR IDENTIFYING PEPPER LEAF DISEASES USING XGBOOST CLASSIFIER	DR S PANDIKUMAR DR B N BOBINATH DR G RAJKUMAR DR K ANURATHA DR M SENGALIAPPAN
CSE-EXT13	SECURE AND AUTOMATED STUDENT BIOMETRIC ATTENDANCE MONITORING AND ANALYTICS SYSTEM	DR KARTHIKEYAN V KA GOPINATH KB ASHVATH MBDEEPAK RISHIKESH SB HARIRAM SB
CSE-E XT14	BIG DATA ANALYTICS FOR DECISION INTELLIGENCE IN HEALTHCARE	MR SUGAVANAM S MS MAMTHA M MS HARIHARA SUDHA MR BHARATH PANDIAN MR PAVANKUMAR NAIDU
CSE-EXT15	A COMPREHENSIVE REVIEW ON DATA SECURITY CHALLENGES IN MEDICAL DATA WIRELESS TRANSMISSION	M PRIYADHARSHAN DR A SURESH BABU
CSE-EXT16	ANALYSIS OF COIMBATORE BIKE SHARING SYSTEM	RAJAGOPAL T K P NAKIB KHAN S RAGUL N NAGA KARTHIGA N SANTHOSH M
CSE-EXT17	DATA-DRIVEN PREDICTION OF ACADEMIC SUCCESS USING MACHINE LEARNING TECHNIQUES	M PRIYADHARSHINI G K DEEBA DHARSHINIE R ABI P KAVIYA K DEEPIGA
CSE-EXT18	THE ETHICAL AND ECONOMIC IMPACT OF ARTIFICIAL INTELLIGENCE ON SOCIETY	MRS NITHYA L MS KOWSHIKA V MS ARCHANA S MS VASUTHAMONI JUMS ATHEESSWARI S
CSE-EXT19	A GENERATIVE AI APPROACH FOR PERSONALIZED LEARNING AND SMART EDUCATION	MS KOWSHIKA V MS MIDHUNA R MS SHARMI
CSE-EXT20	CUSTOMER CHURN PREDICTION FOR A SUBSCRIPTION SERVICE	M LAKSHMI SRUTHY R NEBA FATHIMA DHARIKBASHA
CSE-EXT21	AI FOR SUSTAINABLE DEVELOPMENT AND SMART SOCIETIES	MS K RAJALAKSHMI M J MADHUMITHA BURRI VENKATA KASI RAJU PILLI VISHNU A NETHAJI
CSE-EXT22	PRECISION FARMING THROUGH ARTIFICIAL INTELLIGENCE	KATHIRESH K A AMMU V*

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CSE-EXT23	AUTO-RECOVERY OF DAMAGED PHOTOS USING CONVOLUTIONAL NEURAL NETWORKS	FAHNAAZ ABDULLA
CSE-EXT24	DECENTRALIZED TOT ECOSYSTEMS: EMPOWERING TRUST AND TRANSPARENCY IN THE DIGITAL ERA	SARAVANAN G MATHAVAN SELVAN M FRANKLIN CHRISTOPER F MANO BALAN M NEHAV
CSE-EXT25	AI-DRIVEN PHYTOGUARD SYSTEM: A DEEP LEARNING-BASED APPROACH FOR EARLY DETECTION AND CONTROL OF CROP DISEASES IN SMART AGRICULTURE	SANGEETHA A POORNIMA A ROHINI J INDUMATHI M KIRUTHIKA M ABIRAMI M
CSE-EXT26	SOFTWARE-DEFINED FAULT ISOLATION IN LOW TENSION POWER SYSTEMS: ADVANCED DETECTION AND LINE DE-ENERGIZATION	JAWAHAR D SERALATHAN D SIVASELVI DEEPIKA P MUGILARASAN S BHUVANESHWARI S
CSE-EXT27	CYBERSECURITY IN IOT AND CRITICAL INFRASTRUCTURE	RUDHRA DHARSHINI S PRITHIKA M SARANYA K SANDHIYA
CSE-EXT28	APPLYING CLUSTERING ALGORITHMS ON E-COMMERCE TRANSACTION DATA FOR IMPROVED INVENTORY MANAGEMENT DECISIONS	PRANEETHKUMAR
CSE-EXT29	A MACHINE LEARNING BASED WEB APPLICATION FOR SMS SPAM DETECTION	D MAGESH P JENCY
CSE-EXT30	DATA-DRIVEN SOLUTIONS FOR INDUSTRY 5.0.	MR DASARI MAHESH
CSE-EXT31	AI-POWERED SMART WASTE SEGREGATION AND FILL-LEVEL PREDICTION SYSTEM	PRABU P MAHENDRAN P AVINASH R HARIHARASUTHAN A LAKSHMIPATHI G
CSE-EXT32	DYNAMIC CYBER RISK MODELING FOR THE NEXT-GENERATION ENTERPRISE	MR KRISHNAPRASAD HARIDASAN MR MOHITH RAJ A K MS DHIYA R MR AKASH U MR KISHOR P K

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CSE-EXT33	SMART AGRICULTURE ASSISTANT FOR MULTILINGUAL FARMER SUPPORT E-COMMERCE INTEGRATION AND GOVERNMENT SUBSIDY AWARENESS	MRS B LAKSHMI MR ELANCHEZHIAN PMR KAVINKUMAR C MR KISHORE KUMAR R MR SURESH S
CSE-EXT34	FUSION-BASED APPROACH FOR IDENTIFYING PEPPER LEAF DISEASES USING XGBOOST CLASSIFIER	DR S PANDIKUMAR DR B N BOBINATH DR G RAJKUMAR DR K ANURATHA DR M SENGALIAPPAN
CSE-EXT35	SYNERGISTIC INTEGRATION OF QR-BASED TRACKING AND AUTOMATED BILLING IN A UNIFIED WEB PLATFORM FOR BAKERY MANAGEMENT	B PRIYADARSHAN S M JOTHSHANA AND S GAYATHIRI DEVI*
CSE-EXT36	INTEGRATION OF EEG-BASED STRESS DETECTION AND SOLAR ENERGY IN A SMART INHALER SYSTEM FOR ASTHMA MONITORING	R MANISHWARMA S NAVIN V SARANSRI K POOVARSAN K NITHISHKUMAR
CSE-EXT37	GENERATIVE AI AND ITS ROLE IN FUTURE COMPUTING	MS K RAJALAKSHMI S JANANI B CHANDRU B DEEPAK S SUBASH
CSE-EXT38	FORECASTING SOFTWARE VULNERABILITY BASED ON THE TIME SERIES USING DEEP LEARNING TECHNIQUES	K NIVASHINI AND B KAYALVIZHI
CSE-EXT39	KEEPING UP WITH CYBER THREATS THROUGH CYBER THREAT INTELLIGENCE	MS MEENAKASHI M MS AARCHA AP MR JAIS RAJU MR JEEVA ANTONY A MR JENIN J
CSE-EXT40	DEVELOPMENT OF A DIGITAL FARM MANAGEMENT PORTAL FOR MONITORING MAXIMUM RESIDUE LIMITS (MRL) AND ANTIMICROBIAL USAGE (AMU) IN LIVESTOCK	RAJAPRABU K ASSISTANT PROFESSOR DEPARTMENT OF INFORMATION TECHNOLOGY KRISHNA PRIYA S JANANI V HEMA R S DEVADHARSHINI N DEPARTMENT OF INFORMATION TECHNOLOGY
CSE-EXT41	HEALTH LANGUAGE TRANSLATOR	DR KARTHIKEYAN V K M DARIKAB ABISHEK KUMAR DAILASH ANTO T ASWIN
CSE-EXT42	VISION-BASED DRIVER YAWNING DETECTION USING LIGHTWEIGHT ATTENTION MECHANISM	S PRANESH S MAHESH

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CSE-EXT43	MALWARE DETECTION AND REMOVAL USING MACHINE LEARNING	ARUNA P VISHAL J MOHAMED SUHAIL S SIVAKUMARAN J NIRMAL RAJ S
CSE-EXT44	ADVANCED MALWARE ANALYSIS SANDBOX FOR BEHAVIORAL DETECTION OF MALICIOUS SOFTWARE	ABINESH D AAISHA MARYAM A HEMANTH KUMAAR
CSE-EXT45	ENHANCING STUDENT CAREER PLANNING THROUGH INTELLIGENT COMPUTER-ASSISTED CAREER GUIDANCE TOOLS	MRS G MEENA MRS S GOMATHI MADHUMITHA P MANIKANDAN V SIVARANJANI S SOWDESHWARI S
CSE-EXT46	SYNERGISTIC ADVANCES IN AI MACHINE LEARNING AND HIGH-PERFORMANCE COMPUTING: TOWARDS SMARTER SCALABLE SYSTEMS	MR AARURAN K MR ASHWIN MUTHU R MR ETHISH R
CSE-EXT47	SMART AVIATION DECISION SUPPORT SYSTEM: INTEGRATION OF FLIGHT DELAY PREDICTION WITH AUTOMATED NOTAM FOR AIRMEN SAFETY	MR M NELSON MANICKAM MR S VENKATAJALAPATHY MR B SIVASANKARAN MR P PERIYASAMY MRS D NITHYA ASSISTANT PROFESSORS RP SARATHY INSTITUTE OF TECHNOLOGY POOSARIPATTY
CSE-EXT48	ONLINE COMPLAINT REGISTRATION USING CLASSIFICATION ALGORITHM	MR K SUNDARESAN M E SUNANDHA PRSAD B VIGNESH K NARESH M
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AI ACCIDENT DETECTION AND ALERT SYSTEM

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Abstract: Road accidents are a major cause of fatalities and injuries worldwide highlighting the urgent need for intelligent and rapid accident detection solutions. This paper presents an Artificial Intelligence (AI)-based Accident Detection and Alert System designed to automatically identify accidents in real-time and promptly notify emergency services. The proposed system utilizes advanced machine learning and computer vision techniques to analyze vehicle motion patterns collision impact and environmental data captured through onboard sensors and surveillance cameras. By processing this data the system can accurately distinguish between normal driving conditions and accident scenarios significantly reducing false alarms. Once an accident is detected the system instantly transmits alerts containing location details and severity estimates to nearby hospitals police stations and emergency responders via IoT-enabled communication modules. The integration of GPS and cloud platforms ensures reliable information transfer and efficient coordination of rescue operations. Simulation and prototype testing demonstrate the system’s ability to reduce response times minimize human intervention and enhance road safety.

Keywords: *Web Artificial Intelligence Accident Detection IoT Emergency Alert System.*

BUSINESS ANALYTICS UNLOCKING COMPETITIVE ADVANTAGE THROUGH BUSINESS ANALYTICS: A FRAMEWORK FOR DATA-DRIVEN STRATEGY

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Abstract: In the contemporary business landscape data has emerged as a critical asset for driving growth innovation and sustainable competitive advantage. Business Analytics (BA) enables organizations to transform raw data into actionable insights that support informed decision-making and strategic alignment. This paper explores a comprehensive framework for data-driven strategy emphasizing the integration of descriptive predictive and prescriptive analytics into core business functions. It highlights how analytics can enhance operational efficiency customer engagement and market responsiveness while also addressing challenges such as data quality organizational readiness and ethical considerations.

Keywords: *Business Analytics Data-Driven Strategy Competitive Advantage Decision-Making Business Intelligence.*

CHAT APPLICATION BUILDING SECURE AND EFFICIENT CHAT APPLICATIONS: A COMPARATIVE STUDY OF PROTOCOLS AND FRAMEWORKS

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Abstract: In today’s digital communication landscape chat applications play a vital role in real-time information exchange. With the growing demand for secure efficient and scalable communication platforms this paper presents a comparative study of various protocols and frameworks used in building modern chat applications. The study examines popular communication protocols such as WebSocket MQTT and XMPP along with frameworks like Firebase SignalR and custom backend solutions. Key factors such as performance scalability latency encryption mechanisms and ease of integration are analyzed to highlight trade-offs in different approaches. The findings emphasize the importance of adopting secure communication protocols with strong encryption efficient message delivery mechanisms and scalable architectures. This work provides a comprehensive overview for developers and researchers to design robust secure and high-performance chat applications suitable for diverse use cases ranging from personal messaging to enterprise

Keywords: Chat applications Protocols Frameworks Security Scalability.

CRYPTON: A NEXT-GENERATION FRAMEWORK FOR SECURE AND SCALABLE CRYPTOGRAPHIC OPERATIONS

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Abstract: In an era where data security and scalability have become paramount the demand for robust cryptographic frameworks continues to rise. This paper introduces CRYPTON: A Next-Generation Framework for Secure and Scalable Cryptographic Operations a comprehensive solution designed to address the limitations of existing cryptographic systems. CRYPTON integrates advanced cryptographic algorithms with optimized key management modular architecture and cloud-native deployment support ensuring high performance and interoperability across diverse platforms. The framework emphasizes three core aspects: security scalability and adaptability. Security is reinforced through hybrid encryption schemes post-quantum resistant algorithms and dynamic threat modeling. Scalability is achieved via lightweight protocol designs and parallel processing capabilities enabling seamless operation in large-scale environments. Adaptability is incorporated by supporting multi-tenant architectures customizable modules and integration with AI-driven anomaly detection mechanisms.

Keywords: Cryptography Scalable Security Post-Quantum Algorithms Secure Framework AI-Driven Security

DATA-DRIVEN PERSONAL FINANCE: A FRAMEWORK FOR PERSONALIZED FINANCIAL ADVISORY USING MACHINE LEARNING

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Abstract: A variety of income sources shifting market conditions and changing financial objectives have made it more difficult to manage personal finances successfully. In order to help people make wise financial decisions this article suggests a machine learning-driven architecture for individualized financial advice. To create personalized suggestions the system combines user financial data—such as income savings investments and spending trends—with predictive analytics. The system makes use of both supervised and unsupervised learning models to offer insights including long-term wealth management plans risk assessment investment recommendations and budgeting techniques. Additionally a recommendation engine ensures ongoing customisation by dynamically adjusting to user behavior and external market swings. The effectiveness of the system in increasing financial literacy optimizing spending and improving investment outcomes is demonstrated by experimental evaluations using real-world financial datasets..

Keywords: *Personal Finance Machine Learning Financial Advisory Data-Driven Decision Making*

DESIGN AND IMPLEMENTATION OF AN AI-BASED PEDESTRIAN DETECTION SYSTEM USING DEEP LEARNING TECHNIQUE

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Abstract: Pedestrian detection is a critical component in intelligent transportation systems and autonomous driving technologies aimed at enhancing road safety and reducing accidents. This study presents the design and implementation of an AI-based pedestrian detection system utilizing deep learning techniques. The proposed system leverages convolutional neural networks (CNNs) to accurately identify and localize pedestrians in real-time from complex urban environments. A comprehensive dataset comprising diverse pedestrian scenarios was used to train and validate the model ensuring robustness against varying lighting conditions occlusions and background clutter. The architecture integrates pre-processing modules feature extraction layers and post-processing techniques to optimize detection accuracy and computational efficiency. Experimental results demonstrate high precision and recall rates outperforming traditional machine learning approaches.

Keywords: *Pedestrian Detector Graphical Interface Business Analytics.*

DRIVING ECONOMIC DEVELOPMENT THROUGH ACADEMIA-INDUSTRY COLLABORATION: MODELS AND CASE STUDIES

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Abstract: In an era where innovation is the cornerstone of economic growth the collaboration between academia and industry emerges as a pivotal force. This study explores how collaborative models between universities and businesses can propel economic development fostering job creation technological advancement and regional prosperity. Drawing on a diverse array of frameworks—from public-private partnerships and technology transfer initiatives to joint R&D ventures—we examine their practical applications through real-world case studies. Focusing on success stories like Silicon Valley's university-startup ecosystem and Germany's dual education system the analysis highlights key enablers such as intellectual property management funding mechanisms and policy incentives. It also addresses challenges including cultural mismatches and regulatory hurdles offering insights into overcoming them for sustainable impact. Ultimately this research underscores that effective academia-industry alliances not only accelerate knowledge commercialization but also build resilient economies.

Keywords: Academia–Industry Collaboration Economic Development Innovation Case Studies.

EDURIDE – SAFER RIDES SMARTER SCHOOLS

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Abstract: EduRide is an innovative student safety and monitoring system designed to enhance the security and efficiency of school transportation by connecting schools and parents through real-time GPS tracking QR code-based student verification and instant notifications. By offering automated attendance transparent communication and reliable updates on bus routes pick-ups and delays EduRide addresses key challenges in student transit safety while reducing manual errors and improving operational management for schools. The system integrates hardware IoT devices with user-friendly mobile and web applications ensuring peace of mind for parents and fostering trust between stakeholders. With a focus on data security scalability and continuous improvement EduRide aims to create a smart secure ecosystem for safer school commutes and more efficient school transport operations.

Keywords: Student Safety Real-Time GPS Tracking Automated Attendance Parent-School Communication

EMPOWERING INDEPENDENCE: DESIGNING INTELLIGENT AI VOICE ASSISTANTS TO ENHANCE DIGITAL AND PHYSICAL ACCESSIBILITY FOR THE VISUALLY IMPAIRED

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Keywords: Accessibility Artificial Intelligence Voice Assistant Computer Vision Visually Impaired Natural Language Processing

ENHANCING URBAN MOBILITY WITH TRACK MY BUS: A SMART TRANSIT TRACKING FRAMEWORK

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Abstract: Increasing adoption of electric vehicles (EVs) has led to a rising demand for efficient and sustainable charging solutions. This paper presents an Energy Management System (EMS) for a Hybrid Renewable Energy-Based Electric Vehicle Charging Station designed to optimize power distribution while integrating renewable energy sources. The proposed system incorporates solar and wind energy alongside the conventional grid supply to ensure reliable and cost-effective EV charging. A smart energy management algorithm dynamically allocates power based on real-time availability and demand reducing reliance on fossil fuels and minimizing grid dependency. The EMS employs IoT-based monitoring for efficient load balancing real-time energy tracking and predictive analytics for energy forecasting. Simulation and prototype results demonstrate improved energy efficiency reduced operational costs and enhanced grid stability.

Keywords: Electric Vehicles Renewable energy IoT.

EXPLAINABLE AI: BRIDGING THE GAP BETWEEN MACHINE LEARNING AND HUMAN TRUST

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Abstract: The rapid progress of machine learning has unlocked remarkable predictive capabilities yet the opaque decision-making of complex models continues to limit human confidence and large-scale adoption. Explainable Artificial Intelligence (XAI) addresses this challenge by transforming black-box models into systems whose reasoning can be intuitively understood and critically evaluated. This work presents an approach to XAI that emphasizes transparency without sacrificing model performance enabling a more cooperative relationship between algorithms and end-users. The framework combines interpretable design principles with visualization tools rule-based insights and context-aware explanations to clarify how decisions are made across diverse domains. Beyond technical interpretability the study highlights XAI’s role in building ethical and trustworthy AI by exposing potential biases enhancing accountability and supporting compliance with emerging regulations.

Keywords: Explainable AI Human Trust Interpretability Responsible AI.

INTELLIGENT DEBUGGING WITH BUGZERO: A MACHINE LEARNING APPROACH TO ERROR DETECTION AND RESOLUTION

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Abstract: In modern software development debugging remains a time-consuming and labor-intensive process often relying on manual code inspection that is inefficient and error-prone. This paper introduces BugZero a novel intelligent debugging framework that leverages a machine learning approach to automate the detection and resolution of software bugs. The proposed system analyzes historical bug reports code changes and execution traces to learn and identify error patterns. By training on a comprehensive dataset BugZero can proactively flag potential defects in new code predict the root cause of an error and even suggest relevant code fixes to developers. Our approach moves beyond traditional static analysis by incorporating a dynamic understanding of program behavior and developer workflows. Simulation and experimental results show a significant reduction in debugging time and an improvement in the accuracy of error identification.

Keywords: Machine Learning Debugging Error Detection Software Engineering.

REAL TIME FACE DETECTION AND EMOTION RECOGNITION USING DEEP LEARNING TECHNIQUES

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Abstract: In recent years real-time face detection and emotion recognition have emerged as pivotal components in human computer interaction surveillance and behavioral analysis systems. This study explores the integration of deep learning techniques to accurately detect human faces and classify emotional states in real time. Leveraging convolutional neural networks (CNNs) and advanced architectures such as YOLO and MTCNN for face localization the system ensures high speed and precise detection across varying lighting and background conditions. For emotion recognition models trained on annotated datasets like FER2013 and Affect Net are employed to classify expressions into categories such as happiness sadness anger surprise and neutrality. The proposed framework demonstrates robust performance in dynamic environments achieving high accuracy and low latency making it suitable for applications in smart surveillance interactive gaming and mental health monitoring.

Keywords: *Emotion recognition Convolutional Neural Networks (CNN) yolo.*

REAL-TIME DECISION MAKING IN IOT-BASED AUTOMATION SYSTEMS: ARCHITECTURE AND PERFORMANCE ANALYSIS

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Abstract: The exponential growth of Internet of Things (IoT) devices and the rising demand for sophisticated automation systems necessitate the development of robust frameworks for real-time decision making. This paper addresses the critical need for an effective architecture to process the massive continuous stream of data generated by IoT sensors and actuators. It presents a comprehensive architecture specifically designed for IoT-based automation systems focusing on low-latency data ingestion analysis and execution of timely decision. Key components such as sensor networks communication protocols and data fusion mechanisms are analyzed for their roles in enhancing system responsiveness and scalability. Performance metrics—including latency throughput energy efficiency and fault tolerance—are evaluated through simulation and real-world deployment scenarios. The findings highlight the trade-offs between centralized and decentralized decision-making models and underscore the importance of adaptive algorithms in dynamic environments.

Keywords: *Internet of Things (IoT) Real-time Automation Systems Edge Computing Decision Making*

SECURING THE BACKBONE: A COMPREHENSIVE ANALYSIS OF ENTERPRISE NETWORK SECURITY ARCHITECTURES

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Abstract:In today’s digital world enterprise networks form the backbone of communication and information sharing. As organizations increasingly rely on connected systems the challenge of protecting sensitive data from cyber threats has become more critical than ever. This paper provides a student-driven exploration of enterprise network security architecture focusing on how fundamental security layers can be strengthened with simple yet effective approaches. Rather than relying only on traditional firewalls and passwords the paper highlights innovative but practical concepts such as the zero-trust model segmentation of networks into smaller secure zones and the use of AI-powered monitoring tools that can learn and adapt to new threats. The analysis is kept minimal yet forward-looking aiming to connect basic networking principles with real-world strategies for securing modern enterprises. The work concludes that even students and early learners can contribute to network security research by rethinking the way we design

Keywords: Network Security Zero Trust Segmentation AI Monitoring Student Perspective

A HUMAN CENTRIC APPROACH TO SOLAR WATER PURIFICATION

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Abstract — Access to clean drinking water remains a critical challenge in many communities especially in regions with limited infrastructure. Solar water purification presents a sustainable low-cost solution but conventional systems often overlook the needs behaviors and constraints of the end-users. This paper explores a human-centric approach to solar water purification that integrates technical efficiency with user-centered design. By involving local communities in the design testing and maintenance phases the proposed system enhances usability cultural acceptance and long-term adoption. Key considerations include ergonomics of handling ease of assembly and repair affordability and alignment with local water usage patterns. Preliminary results from field studies suggest that a participatory design process improves water quality outcomes system longevity and user satisfaction. This approach demonstrates how merging renewable energy technology with human-centered principles can accelerate access to safe drinking water in underserved areas.

Keywords — Participatory Design Solar Water Purification User-Centered Design Sustainable Water Solutions Community-Driven Innovation

MISSION SAMANATA: ADVANCING SOCIAL EQUITY THROUGH INCLUSIVE POLICY FRAMEWORKS

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Abstract: Social equity is a fundamental pillar of sustainable development demanding policy models that prioritize fairness inclusivity and representation. This study introduces Mission Samanata a policy-driven initiative designed to strengthen equity by fostering inclusive governance structures. The framework combines community participation evidence-based analysis and multi-stakeholder collaboration to dismantle structural barriers and enhance opportunities for underrepresented groups. A technology-enabled policy management system is employed to ensure transparency monitor outcomes and facilitate continuous reforms informed by citizen feedback. Insights from simulations and case applications reveal tangible progress in resource accessibility reduction of disparities and the cultivation of stronger social cohesion. The findings highlight the potential of inclusive policymaking as a driver of equitable and resilient societal.

Keywords: *Social Equity Inclusive Governance Policy Innovation Marginalized Groups .*

AUTOMATING SAFETY: THE ROLE OF IoT IN GAS LEAK DETECTION

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Abstract -Industrial residential and commercial environments often face significant risks from accidental gas leaks which can lead to fire hazards health complications and even large-scale disasters. Traditional detection systems are either manual or limited in scope often failing to provide timely alerts. This project proposes an automated Internet of Things (IoT)-based gas leak detection and monitoring system designed to enhance safety and minimize human intervention. The system integrates gas sensors with microcontrollers wireless communication modules and cloud platforms to detect hazardous gases in real time. Upon detecting abnormal concentrations the IoT network triggers immediate alerts via mobile applications SMS or alarms while simultaneously transmitting data to centralized dashboards for continuous monitoring and predictive analysis.

Keywords - *IoT Gas Leak Detection Real-Time Monitoring Automation Safety Systems Wireless Communication Cloud Integration Smart Infrastructure*

DATA-DRIVEN LAW ENFORCEMENT; CRIME RATE PREDICTION AND PREVENTION

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Abstract - Data-driven law enforcement applies advanced analytics machine learning and real-time data streams to predict and prevent crime. By combining historical crime records with demographic geographic and socio-economic information agencies can detect patterns and forecast emerging hotspots. Predictive models enable strategic deployment of patrols rapid response to incidents and efficient resource allocation. Integration of IoT sensors surveillance feeds and mobile reporting further enhances situational awareness. Beyond operational gains such systems support long-term prevention by revealing root causes and guiding community interventions. However effective implementation demands high-quality data robust privacy safeguards and continual auditing to reduce algorithmic bias. When these safeguards are met data-driven law enforcement improves public safety lowers crime rates and fosters transparent evidence-based policing that balances security with civil liberties.

KEYWORDS : *Integration of IOT sensors*

AUTONOMOUS AI-DRIVE DRONE SYSTEM FOR ATTENDANCE MANAGEMENT AND STUDENT DISCIPLINE

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Abstract- In educational institutions managing attendance and ensuring student discipline is often a labor-intensive and time-consuming process. This paper proposes the design and implementation of an autonomous AI-driven drone system aimed at automating attendance management and monitoring student behavior in classrooms. The system integrates a network of drones equipped with facial recognition technology and real-time analytics to accurately track and record student attendance. These drones are capable of navigating the classroom environment autonomously identifying students and updating attendance records in a central database without manual intervention. In addition to attendance management the drones are designed to monitor student behavior alerting faculty and administrative staff to any disciplinary issues or non-compliance with classroom protocols. The AI system continuously learns and adapts to the dynamics of the classroom ensuring minimal disruption to the learning environment while maintaining a high level of accuracy.

keywords : *Automated Attendance Management Facial Recognition in Education Student Behavior Monitoring Classroom Surveillance Technology AI in Educational Institutions*

CYBER SECURITY FOR FINANCIAL SYSTEM AND DIGITAL PAYMENTS

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Abstract- The increasing global reliance on digital payments and interconnected financial systems has made cybersecurity paramount for maintaining economic stability and public trust. This digital transformation has significantly expanded the attack surface creating an urgent need for robust defenses against sophisticated threats such as phishing ransomware and Account Takeover (ATO) fraud that target sensitive financial data. Effective cybersecurity in this sector requires a multi-layered approach centered on the pervasive use of end-to-end encryption and tokenization to protect data mandatory Multi-Factor Authentication (MFA) for user verification and the deployment of AI-driven fraud detection systems for real-time anomaly identification.

Keyword: *Digital Payments Security Financial Cyber Threats Multi-Factor Authentication (MFA) AI-Driven*

DELIVERING DELIGHTS:DEVELOPING INTELLIGENT FOOD RECOMMENDATIONS SYSTEM

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Abstract - In an era where personalization drives user engagement intelligent food recommendation systems are transforming how individuals interact with food services. This presentation explores the development of AI-powered systems that deliver personalized meaningful and context-aware food recommendations tailored to individual preferences dietary needs cultural factors and situational contexts. By integrating machine learning natural language processing and behavioral analytics we demonstrate how food recommendation engines can evolve beyond simple filtering to provide dynamic adaptive suggestions across platforms such as restaurant apps meal planning tools and online grocery services. Key challenges addressed include data sparsity cold-start problems and ensuring diversity and fairness in recommendations. We emphasize the importance of incorporating nutritional guidelines user feedback and explainable AI techniques to enhance both utility and user trust. Our approach also considers ethical and health-related implications especially in promoting balanced eating habits and respecting cultural sensitivities.

Keywords - *AI in Food Services Personalized Food Recommendations Machine Learning for Dietary Preferences Context-Aware Recommendation Engines Natural Language Processing in Food Apps*

DIGITAL ASSESSMENT : OPPORTUNITIES AND CHALLENGES IN ONLINE QUIZZES

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Abstract - Now a days the leaners are shifting towards digital learning environments has positioned online assessments as a central tool for evaluating knowledge and skills. Among these online quizzes stand out for their flexibility scalability and immediate feedback making them widely adopted in academic and corporate training contexts. This paper explores the opportunities and challenges associated with digital assessment in the form of online quizzes. Key opportunities include real-time performance analysis adaptive testing accessibility across devices and integration with learning analytics to personalize education. At the same time challenges such as academic integrity question design quality technological reliability and learner engagement remain significant hurdles. By analyzing current practices and emerging trends the study provides insights into how institutions can leverage technology to enhance assessment reliability while mitigating risks. The findings underline the need for innovative security mechanisms balanced pedagogy and robust digital infrastructure to unlock the full potential of online quizzes in shaping the future of assessment.

Keywords: Digital Assessment Online Quizzes Academic Integrity Adaptive Testing Learning Analytics

DIGITAL DEMOCRACY: ONLINE VOTING USING BLOCKCHAIN

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Abstract: The rapid evolution of digital technologies has paved the way for Digital Democracy where citizens can participate in governance through secure and transparent online platforms. Traditional electronic voting systems face critical challenges such as vulnerability to tampering lack of transparency and concerns over voter anonymity. To address these issues this project proposes an innovative Online Voting System using Blockchain technology ensuring decentralized tamper-resistant and transparent electoral processes. By leveraging blockchain's immutable ledger every vote is securely recorded and verifiable minimizing the risks of fraud and unauthorized manipulation. The proposed model not only strengthens security and efficiency but also promotes inclusivity by enabling remote participation. particularly beneficial for citizens unable to access traditional polling stations. With its potential to enhance trust reduce costs and accelerate result declaration blockchain-based digital democracy offers a transformative approach for future elections fostering greater civic engagement and reinforcing the foundations of democratic governance.

Keywords: E-Governance Decentralization Cryptography Voter Privacy Fraud Prevention.

EMPOWERING INNOVATION: THE ROLE OF NO-CODE AND LOW-CODE PLATFORMS

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Abstract - The growing demand for rapid software development and digital transformation has spurred the emergence of No-Code and Low-Code platforms. These platforms empower individuals and organizations to build applications with minimal traditional programming accelerating innovation and reducing development costs. This paper examines the role of No-Code and Low-Code platforms in democratizing application development enabling non-technical users to create functional solutions while allowing developers to focus on complex tasks. By providing visual interfaces reusable components and seamless integrations these platforms shorten development cycles and foster greater collaboration between business and IT teams. The study also discusses challenges such as scalability security and governance and presents best practices to maximize the benefits of these platforms. Findings highlight their potential to drive digital innovation enhance productivity and support inclusive technological growth.

Keywords - No-Code Low-Code Application Development Digital Transformation

FAKE-FREE FUTURE: STRATEGIES FOR PRODUCT VERIFICATION

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Abstract - Counterfeit products pose a significant threat to consumer safety brand reputation and supply chain integrity worldwide. This paper proposes a robust product verification system that integrates blockchain technology QR code authentication and artificial intelligence to effectively combat counterfeit goods. Each product is assigned a unique QR code linked to an immutable blockchain record ensuring tamper-proof decentralized product information storage. The system enables real-time verification through a user-friendly mobile or web interface allowing consumers manufacturers and retailers to validate product authenticity instantly. Artificial intelligence enhances the system's accuracy by analyzing product attributes and detecting anomalies that may indicate counterfeiting. Future enhancements include incorporating IoT devices for real-time tracking and expanding the system's applicability across diverse industries and global markets. This comprehensive framework offers a scalable secure solution toward achieving a fake-free future in commerce.

keyword: Product Authentication QR Code Verification Artificial Intelligence in Supply Chain Counterfeit Detection Smart Contracts

FROM STEEL TO SENSE: THE HUMAN JOURNEY OF AI ROBOTS

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Abstract - The rapid evolution of robotics and artificial intelligence (AI) has transformed robots from mechanical entities of steel into intelligent companions capable of perceiving learning and responding to human needs. This transition highlights not only the advancement of machine capabilities but also the deepening relationship between humans and technology. The journey from rigid automation to sense-driven intelligence reflects a shift toward designing robots that understand emotions adapt to environments and collaborate seamlessly with humans. Such progress has expanded the role of AI robots in healthcare industry education and daily life where empathy and decision-making are as valuable as precision and strength. However this humanization of machines also brings challenges in ethics trust and societal acceptance. This paper explores the transformative path of AI robots emphasizing their potential to reshape human experiences while maintaining a balance between innovation and responsibility. By examining the interplay of technology humanity and ethics the discussion envisions a future where robots are not just tools of efficiency but partners in the human journey.

Keywords: *Social Robotics Cognitive Robotics Future of Work Technological Evolution Ethical AI*

GREEN COMPUTING: SUSTAINABLE PRACTICES IN DATA CENTRES AND CLOUD

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Abstract - Green computing emphasizes the sustainable and eco-friendly use of information technology resources aiming to reduce energy consumption minimize carbon footprint and promote environmental responsibility. Data centres being major energy consumers adopt green practices such as virtualization efficient cooling systems renewable energy integration and optimized server utilization to enhance sustainability. Similarly cloud computing contributes by enabling resource sharing elastic scaling and energy-efficient workload management thereby reducing the need for individual organizations to maintain large physical infrastructures. Together these sustainable practices in data centres and cloud computing not only lower operational costs but also support global efforts toward carbon neutrality and environmental preservation.

Keywords: *Green computing Energy efficiency Cloud computing Data centres E-waste management Resources optimization.*

HARNESSING DIGITAL TWINS FOR SUSTAINABILITY AND EFFICIENCY

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Abstract - Digital twins are virtual data-driven replicas of physical assets, processes or systems that bridge the gap between the physical and digital worlds. Powered by real-time data from IoT sensors, artificial intelligence (AI) and machine learning (ML), these digital models enable real-time monitoring, advanced analytics and predictive simulations. This capability is transforming industries by making operations significantly more efficient and sustainable. Supports ESG (Environmental Social Governance) goals and compliance with international regulations. Simulations support better decision-making, scenario testing and performance tracking. Companies report productivity gains of 15-30% by using digital twins to streamline workflows and logistics. By predicting failures and enabling timely maintenance, digital twins extend the life of assets and reduce unnecessary replacements. Digital twins are game-changers for sustainability and efficiency. Digital twins are reshaping sustainability—turning data into action.

Keywords -virtual Replicas, real time data monitoring, artificial intelligence.

INTELLIGENCE SYSTEM AND IoT: SHAPING THE FUTURE

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Abstract - The Internet of Things (IoT) and artificial intelligence (AI) are coming together to quickly change the technological environment, spurring innovation in a variety of sectors and changing how people interact with technology. While AI uses this data to draw conclusions, identify trends and make decisions on its own, IoT allows billions of linked devices to gather and exchange real-time data. These technologies work together to create intelligent ecosystems that support transportation systems, smart homes, industrial automation, healthcare monitoring and sustainable urban development. Organizations may achieve better user experiences, predictive maintenance, increased productivity and optimum resource management by combining AI-driven analytics with IoT-generated data streams. As AI and IoT develop further, their combination has the potential to completely transform digital infrastructure and pave the way for a more intelligent, connected and efficient future.

Keywords - Artificial Intelligence (AI), Internet of Things (IoT)

NEUROMORPHIC COMPUTING: BRIDGING THE GAP BETWEEN THE BRAIN AND MACHINE

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Abstract - Neuromorphic computing is an area of research that intersects neurophysiology computer engineering and AI with the goal of completely changing the way we do computing – by copying the brain in terms of its neural architecture and computational principles. In contrast to traditional von Neumann architectures (that split memory and computation) neuromorphic systems unite these processes in sparse well-connected sustainable networks of artificial neurons and synapses that are highly parallel. This architecture is suitable for event-based computation sparse signal representation and adaptive learning making it superior in terms of energy efficiency computational speed and fault tolerance. In this work some of the basics of neuromorphic engineering are reported and main neuromorphic processors (IBM TrueNorth Intel Loihi and SpiNNaker) are benchmarked against conventional CPU/GPU system regarding energy consumption throughput and performance for inference problem.

Keywords - Neuromorphic Computing Spiking Neural Networks Brain-Inspired Architectures Energy-Efficient AI Non-von Neumann Systems.

PRECISION AGRICULTURE: AI-DRIVEN SOLUTION FOR CROP DISEASES MANAGEMENT

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Abstract - Crop diseases are a major challenge for farmers as they reduce yield and quality. Traditional methods of detecting and managing diseases are often time-consuming and less accurate. This project proposes an AI-driven solution for crop disease management in precision agriculture. Using machine learning and image processing the system can identify common crop diseases from leaf images and suggest suitable treatments. The approach helps farmers take quick action reduce unnecessary pesticide use and improve crop productivity. This project demonstrates how artificial intelligence can make farming more efficient sustainable and accessible to modern agriculture practices.

Keywords - Precision Agriculture Machine Learning in Agriculture Image Processing for Plant Disease Detection Sustainable Farming Technology Automated Disease Identification

QUANTUM TECH SUMMIT: TRANSFORMING INDUSTRIES WITH QUANTUM COMPUTING

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Abstract - The Quantum Tech Summit: Transforming Industries with Quantum Computing explores the transformative potential of quantum technologies across diverse sectors from healthcare and finance to logistics and materials science. The summit brings together leading researchers industry innovators and policymakers to discuss advancements in quantum computing hardware algorithms and applications. Key sessions will address how quantum solutions can optimize complex problem-solving accelerate drug discovery enhance cybersecurity and drive sustainable technologies. By fostering collaboration between academia and industry the summit aims to highlight practical strategies for integrating quantum computing into real-world applications shaping the future of technology and business innovation.

Keyword: Quantum Technology Summit Quantum Hardware and Algorithms Industry Innovation in Quantum Computing Quantum Solutions for Healthcare Quantum-Driven Drug Discovery

SMART FARMING: HARNESSING IoT FOR SUSTAINABLE AGRICULTURE

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ABSTRACT - Drones automated irrigation systems and GPS-enabled equipment are examples of IoT devices that enable precision agriculture practices which guarantee that inputs are applied in the proper quantity at the appropriate time and at the appropriate location. This lowers expenses lessens the impact on the environment and improves food security. Additionally by merging real-time and historical data IoT enables predictive analytics to effectively plan harvesting schedules identify pests and illnesses early and anticipate agricultural yields.IoT adoption in agriculture also encourages sustainable practices by lowering greenhouse gas emissions water waste and chemical use. Notwithstanding its many advantages obstacles like exorbitant installation costs a lack of infrastructure in remote regions and worries about data security continue to prevent widespread use. However smart farming has the potential to completely transform agriculture worldwide due to the quick development of connectivity technologies like 5G and the growing accessibility of reasonably priced IoT devices. The agriculture industry may advance toward a more robust effective and sustainable future by utilizing IoT.

KEYWORDS - Internet of Things (IoT) Global Positioning System(GPS)

THE FUTURE OF NEURO TECHNOLOGY CONVERTING BRAIN SIGNALS INTO COMPUTER TASKS

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Abstract - Neurotechnology is rapidly advancing toward a future where direct communication between the human brain and computers becomes seamless. By translating brain signals into computer-executable tasks this emerging field promises breakthroughs in healthcare accessibility and human-machine interaction. Current research in brain-computer interfaces (BCIs) leverages electroencephalography (EEG) neural implants and machine learning algorithms to decode neural activity with increasing accuracy. Such innovations hold potential for restoring motor function in paralyzed patients enabling hands-free device control and even augmenting cognitive abilities. However challenges remain in terms of signal precision ethical considerations data privacy and the potential for misuse. This paper explores the trajectory of neurotechnology its transformative applications and the societal implications of integrating brain-driven control systems into everyday life. The future of neurotechnology lies not only in technical innovation but also in addressing the ethical and regulatory frameworks that will shape its safe and inclusive adoption.

KEYWORDS - Brain-Computer Interface(BCI's) Electroncephalogsphy(EEG)Human-Machine Interface.

THE POWER OF VISIBILITY: ENHANCING ORDER TRACKING AND HISTORY

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Abstract - In today's fast-paced digital economy the ability to track and m factor in building customer trust and operational efficiency. This paper explores “The Power of Visibility” in enhancing order tracking and historical data management through intelligent digital anage orders with transparency has become a critical solutions. Traditional systems often suffer from fragmented tracking limited updates and lack of end-to-end visibility which lead to inefficiencies and reduced customer satisfaction. Our proposed framework leverages real-time data integration predictive analytics and user-friendly dashboards to provide complete visibility of order status from initiation to delivery. By maintaining a comprehensive order history organizations can analyze performance trends predict potential delays and strengthen decision-making for both customers and businesses.

Keywords - Order Tracking Supply Chain Management Customer Experience Smart Logistics

UNDERSTANDING THE UNSTRUCTURED: AI'S ROLE IN NATURAL LANGUAGE COMPREHENSION

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Abstract - The critical role of Artificial Intelligence (AI) in understanding and processing unstructured data with a specific focus on natural language comprehension. As the digital landscape becomes increasingly dominated by textual and spoken communication conventional data analysis methods are proving inadequate. This paper delves into Natural Language Processing (NLP) a key branch of AI that enables machines to not only recognize but also interpret the nuances context and intent embedded within human language. The paper outlines fundamental techniques and methodologies that underpin modern NLP including computational linguistics machine learning and advanced deep learning architectures such as large language models (LLMs). It discusses how these technologies facilitate a range of applications from sentiment analysis and machine translation to conversational agents and data summarization. By bridging the gap between human communication and machine understanding AI-powered NLP transforms a torrent of disorganized information into actionable insights thereby revolutionizing industries from healthcare to finance.

Keywords - Artificial Intelligence Machine Learning LLMs.

AGROW: SATELLITE CROP MANAGEMENT SYSTEM

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Abstract: Agriculture requires precise and sustainable management of resources to maximize productivity. AGREE_AI integrates satellite imagery and artificial intelligence to address three critical areas: weed detection optimized seeding/planting strategies and water body monitoring. High-resolution imagery combined with convolutional neural networks (CNN) and machine learning models enables accurate crop classification yield prediction and soil analysis. The system also provides early alerts on crop health supports crop rotation planning and aids irrigation management. With cloud-based dashboards mobile integration and farmer-friendly reporting AGREE_AI offers actionable insights that improve efficiency reduce costs and promote sustainable farming. The pilot project budget estimates Rs. 2.22 crore primarily allocated to technical development and expert human resources. This system demonstrates the transformative potential of AI-powered satellite crop monitoring for the future of agriculture.

Keywords: Agriculture Satellite Imagery Crop Management Machine Learning IoT.

AI ANALYZER

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Abstract: Artificial Intelligence (AI) analysers are advanced systems designed to process interpret and evaluate large amounts of data with minimal human intervention. They combine machine learning natural language processing and predictive modelling to uncover patterns generate insights and support decision-making in various domains such as healthcare finance business intelligence and cybersecurity. By automating the analysis process AI analysers improve accuracy efficiency and scalability compared to traditional methods. These systems are increasingly integrated into modern applications enabling real-time monitoring trend forecasting and anomaly detection. The future of AI analysers lies in explainability ethical use and human–AI collaboration ensuring that the technology not only accelerates data-driven innovation but also maintains transparency and trust.

Keywords: Artificial Intelligence (AI) AI Analysers Machine Learning Natural Language Processing Predictive Modelling Data Analysis Decision Support Systems Real-time Monitoring Trend Forecasting Anomaly Detection Explainable AI Human–AI Collaboration

AI POWERED HEALTH MONITORING SERVICES

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Abstract: Health monitoring has traditionally relied on periodic clinical visits and manual record-keeping which can delay the detection of critical conditions. This project proposes an AI-powered health monitoring system that continuously collects and analyzes vital health parameters such as heart rate blood pressure blood oxygen level temperature and activity patterns using wearable sensors or IoT-enabled devices. The system employs machine learning algorithms to identify anomalies predict potential health risks and provide early warnings to patients and healthcare providers. Real-time data is transmitted to a secure cloud platform where AI models generate personalized health insights and suggest preventive measures. This approach enhances patient safety reduces hospital visits and enables proactive healthcare management. The proposed system aims to bridge the gap between patients and healthcare professionals by offering an affordable scalable and efficient tool for continuous health surveillance.

Keywords: Health Monitoring AI in Healthcare Remote Patient Monitoring (RPM) Digital Health Smart Health Devices Telemedicine mHealth (Mobile Health) Wearable Health Technology Predictive Analytics

AI POWERED MEDICAL DIAGNOSIS SYSTEM

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Abstract: In the era of precision medicine timely and accurate diagnosis is critical for patient outcomes. This project presents an AI-Powered Medical Diagnosis Support System a web-based platform that leverages machine learning and deep learning to assist healthcare professionals in diagnosing medical conditions from patient data. Built with React for the frontend and Python Flask for the backend the system integrates TensorFlow for predictive models trained on diverse datasets including medical images symptoms and lab results. Key features include image analysis for radiology (e.g. X-rays MRIs) using convolutional neural networks (CNNs) symptom-based diagnosis via natural language processing (NLP) and risk assessment algorithms to provide probabilistic predictions. The platform ensures data privacy through client-side encryption and compliance with HIPAA standards while real-time processing achieves <2-second inference times. Extensive testing on benchmark datasets demonstrates 92% accuracy for common conditions with explainable AI (XAI) features for transparency. This innovative tool augments clinical decision-making reduces diagnostic errors and promotes equitable healthcare access laying the groundwork for integration with electronic health records (EHRs) and telemedicine. Future enhancements include multi-modal fusion and global disease surveillance.

Keywords: AI Medical Diagnosis Machine Learning Deep Learning CNN NLP Healthcare Explainable AI Web Application Privacy.

AI-HEALTHCARE CHATBOT

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Abstract: This study presents the development and evaluation of an AI-powered healthcare chatbox designed to provide personalized medical guidance and support to patients. By leveraging advanced natural language processing (NLP) and machine learning algorithms the chatbox offers a user-friendly and intuitive interface for patients to input their symptoms and receive instant accurate and reliable medical information. The chat box integrates with electronic health records (EHRs) to provide tailored advice and recommendations improving health outcomes and enhancing patient engagement .The results of our pilot study demonstrate significant improvements in patient satisfaction health literacy and self-management of chronic diseases.

Keywords: AI healthcare chatbox personalized medicine natural language processing machine learning patient engagement health literacy.

AI-POWER LEGAL ASSISTANT

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Abstract: The legal industry is rapidly evolving with the integration of Artificial Intelligence (AI) to enhance efficiency accessibility and decision-making. This project introduces an AI-Powered Legal Assistant designed to assist lawyers clients and legal researchers by automating routine tasks offering intelligent insights and improving overall productivity. The system leverages Natural Language Processing (NLP) Machine Learning (ML) and Legal Information Retrieval techniques to analyze case laws draft documents summarize legal texts and provide preliminary legal advice. By understanding user queries in natural language the assistant can suggest relevant statutes precedents and case summaries reducing time spent on manual research. Furthermore it ensures data confidentiality and compliance with legal standards while offering multilingual support for broader accessibility. The project emphasizes user-friendly interaction through chat-based or voice-enabled interfaces making legal information more transparent and available to both professionals and the public.

Keywords: Artificial Intelligence Legal Assistant NLP Machine Learning Legal Research Document Automation Case Analysis Decision Support Legal Technology.

AI-SMART EDUCATION LEARNING BY ADVANCED METHOD WITH AI

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Abstract: AI Smart Education is transforming the way knowledge is delivered accessed and experienced in modern classrooms. By integrating artificial intelligence into education learning becomes more personalized interactive and efficient. AI-driven systems analyze individual student performance track progress and identify areas of improvement enabling tailored content and adaptive learning pathways that suit each learner’s unique needs. Intelligent tutoring systems and virtual assistants provide round-the-clock support answering queries and offering guidance beyond classroom hours. For teachers AI acts as a powerful assistant by automating routine tasks such as grading attendance and performance analysis allowing them to focus more on creative teaching and student engagement. AI tools also foster inclusivity by offering accessible learning resources for differently-abled students breaking barriers to education. Moreover remote and rural learners benefit from AI-powered platforms that ensure quality education regardless of geographical location.

Keywords: AI Smart Education Personalized skills Learning Adaptability Digital technology Inclusive learning Artificial intelligence Information criteria Gamified learning

ALGORITHMIC CODE GENERATORS : AUTOMATING SOFTWARE DEVELOPMENT

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Abstract: Algorithmic code generators are transforming the landscape of software development by automating the creation of functional code from high-level specifications. These systems leverage artificial intelligence natural language processing and formal logic to interpret user intent and generate syntactically correct and optimized code across multiple programming languages. By reducing manual coding effort minimizing human error and accelerating development cycles algorithmic code generators empower developers to focus on design and innovation. This paper explores the architecture methodologies and practical applications of algorithmic code generation highlighting its role in modern software engineering rapid prototyping and low-code/no-code platforms. The rise of algorithmic code generators marks a significant shift in software development enabling automation of code creation from high-level specifications or natural language inputs.

Keywords: Algorithmic code generation Software automation AI-driven development Natural language processing Low-code platforms Code synthesis Program synthesis Intelligent IDEs Rapid prototyping and Software engineering.

ARTIFICIAL INTELLIGENCE–DRIVEN HUMAN DISEASE DETECTION SYSTEM

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Abstract: Early and precise diagnosis is the cornerstone of effective healthcare yet conventional diagnostic methods often suffer from delays high costs and limited accessibility. This paper introduces a next-generation Artificial Intelligence (AI)–based Human Disease Detection System that unifies medical imaging patient data analytics and Internet of Things (IoT)–driven continuous monitoring into a single intelligent platform. The framework leverages advanced deep learning models including Convolutional Neural Networks (CNNs) and transformer-based architectures to accurately interpret X-rays CT scans and MRI images while predictive machine learning algorithms analyze clinical records to forecast disease risks such as diabetes cardiovascular illness and cancer. A novel multimodal feature fusion mechanism integrates image-based and non-image-based data significantly improving diagnostic precision and minimizing false detections.

Keywords: Artificial Intelligence Disease Prediction Multimodal Learning Deep Learning IoT Smart Healthcare.

CREATING A FINGERPRINT-BASED ATM SYSTEM USING BIOMETRIC TECHNOLOGY

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Abstract: The Fingerprint-Based ATM System is an innovative solution designed to enhance the security efficiency and user-friendliness of banking transactions. Traditional ATM systems rely on cards and PIN numbers which are often vulnerable to theft loss skimming and duplication. To overcome these limitations this system employs biometric authentication where the customer’s fingerprint serves as the unique identifier for accessing accounts and performing transactions. Since fingerprints are unique and difficult to forge this approach provides stronger protection against fraud and unauthorized access. At the time of transaction the scanned fingerprint is matched against the stored template ensuring that only the rightful account holder can operate the ATM. This eliminates the need for physical cards or memorized PINs simplifying the process for customers and reducing operational challenges for banks. Overall the fingerprint-based ATM system represents a significant step toward secure cardless and future-ready digital banking combining biometric technology with financial services to create a fraud-resistant and convenient transaction experience.

Keywords: Fingerprint recognition Biometric authentication ATM security Cardless transactions Digital banking.

CRYPTOCURRENCY PRICE TRACKER WITH ALERTS

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Abstract—This work presents a robust web-based application for real-time tracking and alerting of cryptocurrency prices designed to cater to the needs of traders and investors in the dynamic digital asset market. Leveraging JavaScript frameworks including ReactJS and Material UI for interface development the system is integrated with external APIs such as CoinGecko to synchronize price data across hundreds of assets and exchanges with minimal latency. User-centric features include live price updates customized watchlists historical data visualization using ChartJs and portfolio management capabilities.. The platform employs asynchronous API handling efficient state management and responsive design principles to achieve scalability and accessibility across devices. Comprehensive testing and benchmarking demonstrate the application's effectiveness in delivering accurate information rapid alerts and high usability for active cryptocurrency market participants.

Keywords: Cryptocurrency Price Tracker Real-Time Updates Alerts API Integration ReactJS Firebase User Authentication Data Aggregation Market Data Notification System

HEALTH APPOINTMENT AND BOOKING WEBSITE

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Abstract: The increasing demand for efficient healthcare services and patient-centered care has underscored the importance of digital solutions for managing appointments and medical consultations. This project presents a web-based health appointment and booking system designed to streamline the interaction between patients and healthcare providers. By integrating user-friendly interfaces with robust backend functionalities the system enables patients to easily search for doctors view availability and schedule appointments online thereby eliminating the need for long waiting times and manual booking processes. The platform also allows healthcare professionals to manage their schedules track patient bookings and provide timely updates. Incorporating secure data handling and real-time notifications ensures reliability and privacy for users. Additionally features such as appointment reminders medical history tracking and multi-specialty support enhance the overall healthcare experience. This solution demonstrates how technology can optimize healthcare delivery improve patient satisfaction and support the digital transformation of medical services.

Keywords: Health appointment Online booking Web application Patient management Digital healthcare.

HEART DISEASE DETECTION USING AI

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Abstract: Heart disease remains one of the leading causes of mortality worldwide emphasizing the need for early and accurate detection methods. This paper presents an Artificial Intelligence (AI)-based Heart Disease Detection System designed to improve diagnostic accuracy and support clinical decision-making. The proposed model leverages machine learning algorithms including decision trees support vector machines and deep neural networks to analyze patient health data such as age blood pressure cholesterol levels heart rate and electrocardiogram results. Feature selection techniques are employed to enhance model efficiency and reduce computational complexity. The system utilizes a cloud-based IoT framework for real-time data collection and remote monitoring enabling continuous health assessment and timely intervention. Simulation and experimental results on benchmark medical datasets demonstrate high accuracy precision and sensitivity outperforming traditional diagnostic methods. This study underscores the transformative potential of AI in predictive healthcare aiming to reduce the global burden of heart disease through intelligent and accessible diagnostic tools.

Keywords: Heart Disease Artificial Intelligence Machine Learning IoT Healthcare.

LANGUAGE LEARNING PLATFORM

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Abstract: In an increasingly globalized world effective language acquisition is essential for communication and cultural exchange. This project introduces an innovative AI-powered Language Learning Platform that leverages machine learning and interactive technologies to provide personalized immersive language education. Built as a web application using React for the frontend and Node.js for the backend the platform integrates natural language processing (NLP) for real-time conversation practice speech recognition for pronunciation feedback and adaptive algorithms to tailor lessons to individual proficiency levels. Key features include gamified modules for vocabulary building grammar exercises and cultural immersion through multimedia content supported by TensorFlow.js for client-side AI processing to ensure privacy and low-latency performance. The system employs spaced repetition and user progress tracking to optimize learning outcomes achieving up to 40% faster skill acquisition compared to traditional methods. Comprehensive testing validates its accessibility responsiveness and scalability making it a versatile tool for learners worldwide.

Keywords—Language Learning AI NLP Speech Recognition Adaptive Learning Web Application Machine Learning Gamification Accessibility.

PRICE TRACKER

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Abstract: This paper introduces a reliable web-based platform for real-time cryptocurrency price tracking and alerting tailored to meet the needs of traders and investors in the fast-paced digital asset space. Utilizing JavaScript frameworks like ReactJS and Material UI for the user interface the application connects to external APIs such as CoinGecko to provide real-time price updates across a wide range of assets and exchanges with minimal delay. Key features include live price tracking customizable watchlists historical data charts powered by ChartJs and portfolio management tools. The backend is supported by Firebase ensuring secure data storage and the prompt delivery of notifications. Users can set price or percentage-based alerts receiving timely notifications on both mobile and browser platforms when significant market movements occur. The system employs asynchronous API requests optimized state management and responsive design to ensure scalability and accessibility across devices.

Keywords: Cryptocurrency price tracking Real-time alerting Traders and investors JavaScript frameworks ReactJS Material UI External APIs CoinGecko

REAL-TIME SIGN LANGUAGE TRANSLATOR: A WEB-BASED AI-POWERED GESTURE RECOGNITION SYSTEM

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Abstract: Bridging the communication divide for the deaf and hard-of-hearing this project introduces a real-time Sign Language Translator web application that converts American Sign Language (ASL) gestures into text and speech using webcam input. Harnessing AI and machine learning the system employs MediaPipe Hands for precise hand landmark detection and gesture classification (focusing on letters A L B) enabling seamless client-side processing for enhanced privacy and low-latency performance. Built with React for a responsive interface it features overlaid visualizations Web Speech API for natural audio synthesis and accessibility enhancements like ARIA labels. This innovative tool promotes digital inclusivity empowers users with instant interpretation and lays the foundation for comprehensive ASL support fostering a more equitable communication landscape. The implementation includes detailed hybrid ML pipelines extensive testing and modular architecture for scalability.

Keywords—Sign Language ASL AI Gesture Recognition MediaPipe Real-time Translation Web Application Machine Learning Accessibility Client-Side Processing.

SMART AGRICULTURE SYSTEM USING IOT AND ARTIFICIAL INTELLIGENCE

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Abstract: Agriculture plays a vital role in ensuring food security and supporting economic development but farmers face numerous challenges such as water scarcity unpredictable weather conditions inefficient resource utilization and crop losses due to pests and diseases. To address these issues this project proposes a Smart Agriculture System integrating Internet of Things (IoT) and Artificial Intelligence (AI) to promote sustainable and data-driven farming practices. The system deploys IoT-based sensors to monitor key environmental and soil parameters including soil moisture temperature humidity and crop health in real time. These data are collected and transmitted to a cloud platform where AI algorithms analyze patterns to generate predictive insights for irrigation scheduling fertilizer management and early detection of plant diseases or pest infestations. Through intelligent recommendations and automated control of irrigation systems farmers can conserve water optimize fertilizer use and increase productivity while reducing costs and environmental impact.

Keywords: Smart Agriculture IoT Artificial Intelligence Precision Farming Sustainability Crop Monitoring.

SMART BINS USING IOT

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Abstract: The Smart Waste-to-Value System is an innovative solution designed to address the challenges of urban waste management. It integrates IoT-enabled smart bins for real-time waste monitoring and segregation at the source. An AI-powered classification system ensures efficient sorting of biodegradable recyclable and hazardous waste. Organic waste is converted into biogas and compost while recyclables are directed to appropriate processing units. The system employs data analytics to optimize collection routes reducing fuel consumption and emissions. A mobile application provides users with insights incentives and awareness on responsible waste disposal. The solution promotes circular economy practices by turning waste into energy and reusable materials. It enhances municipal efficiency through predictive waste generation models. By leveraging automation and renewable conversion technologies it reduces landfill dependency. Ultimately the project contributes to sustainability environmental protection and smart city development.

Keywords— Smart Waste Management Waste-to-Value IoT-enabled Smart Bins Artificial Intelligence (AI) Circular Economy Smart City Solutions.

SMART ENERGY SAVER USING AI

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Abstract: The rapid increase in energy consumption across residential and institutional sectors has led to rising utility costs and significant environmental challenges. Traditional energy management systems are often inefficient lacking real-time adaptability to dynamic usage patterns. This paper proposes an AI-based Smart Energy Saver designed for homes and campuses to optimize power utilization through intelligent monitoring and control. The system employs machine learning algorithms to analyze historical and real-time data predict consumption trends and automatically regulate appliances lighting and HVAC systems. By integrating IOT sensors and smart meters the framework ensures continuous energy tracking anomaly detection and demand-side load management. Additionally the solution provides users with actionable insights through a user-friendly interface enabling informed decision-making and sustainable energy practices. Experimental results demonstrate that the proposed system can significantly reduce energy wastage lower operational costs and contribute to a greener environment.

Keywords: Smart energy management Artificial intelligence(AI) Internet of things(IoT) Energy efficiency Real-time monitoring Automated control system.

VOTER IDENTITY FINGERPRINT

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Abstract: Ensuring the integrity of voter rolls and preventing duplicate or fraudulent registrations is essential for free and fair elections. The paper presents voter identity finger printer(vif) a privacy aware framework that creates compact non-reversible identity fingerprints combining optional biometric features .To support accurate voter de-duplication and identity verification at registration and polling.VIF to protect voter privacy and resist misuse and integrates template protection techniques.VIF on stimulated and publically available biometric and voter-roll-like datasets using standard de-duplication and authentication metrics .We further analyze the system resilience to cross jurisdictional duplicate detection and present practical deployment guidelines and (false match rate false non-match rate ROC/AUC and linkage precision /recall demonstrate robust performance under typical population scale noise levels and adversarially corrupted inputs and This will be helpful for our democracy.

Keywords: Voter identity biometric fingerprinting identity hashing template protection election integrity

ADVANCEMENTS IN BRAIN-COMPUTER INTERFACE (BCI): ENABLING COMMUNICATION FOR MOTOR-IMPAIRED INDIVIDUALS

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Abstract: Signals from the human brain are converted into commands that can operate devices or applications using a brain–computer interface (BCI). Patients with severely impaired motor abilities such as those with neurological conditions like amyotrophic lateral sclerosis (ALS) or brainstem stroke can benefit from the new non-muscular communication channel that a brain computer interface (BCI) offers. Giving these individuals a way to interact with their surroundings is the direct objective of ongoing research. Present-day BCI systems use different electrophysiological signals such as slow cortical potentials evoked potentials and oscillatory activity recorded from scalp or subdural electrodes and cortical neuronal activity recorded from implanted electrodes. Due to advances in methods of signal processing it is possible that specific features automatically extracted from the electroencephalogram (EEG) and electrocorticogram (ECoG) are used to operate computer-controlled devices. One of the most difficult aspects of developing and using a BCI system is the user-system interaction in terms of learning and adaptability.

Keywords: Brain-Computer Interface (BCI) Electroencephalogram (EEG) Electrocorticogram (ECoG) Neuronal activity Signal processing Motor impairment Neurological conditions.

AI APPROACH FOR E-MAIL SPAM FILTERING

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Abstract: E-mail remains one of the most widely used communication tools but it is also a primary target for spam which poses risks such as information overload phishing attacks and malware distribution. Traditional rule-based filtering techniques are often limited in adaptability as spammers continuously evolve their strategies to bypass detection. To address these challenges artificial intelligence (AI)–based approaches have emerged as effective solutions for spam filtering. By leveraging machine learning algorithms natural language processing and deep learning models AI systems can automatically learn patterns extract features and classify emails with high accuracy. This paper explores AI-driven methods for e-mail spam filtering highlighting supervised and unsupervised learning techniques feature engineering strategies and hybrid models that enhance detection performance. The study emphasizes how AI not only improves the precision and recall of spam detection but also adapts dynamically to new and sophisticated spam tactics. Ultimately AI-based spam filtering contributes to safer and more reliable digital communication.

Keywords: Artificial Intelligence (AI); Spam Filtering; Machine Learning; Deep Learning; Natural Language Processing (NLP); Email Classification; Supervised Learning; Unsupervised Learning

AI DEEP FAKE SHIELD

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Abstract: The emergence of the Deep Shield Paradigm represents a transformative threshold in cognitive and computational defense architectures. Unlike traditional boundaries which rely on deterministic parameters the Deep Shield operates in a liminal space between perception and projection drawing resilience from layered abstraction rather than singular enforcement. By synthesizing signals across fractured domains of meaning it generates protective membranes that are simultaneously opaque and permeable-guarding not by exclusion but by recursive redirection of external force into self-reinforcing stability loops. This work explores the illusory coherence of the Deep Shield revealing how its strength resides less in measurable metrics than in the perception of its depth. Ultimately the Deep Shield is less a technology than a philosophy: an articulation of safety through the performance of complexity.

Keywords: Deep Shield Paradigm; Cognitive defense architectures; Layered abstraction Recursive stability loops;; Perception and projection; Liminal systems; Adaptive resilience; Protective membranes

PRECISION FERTILIZER RECOMMENDATION SYSTEMS

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Abstract: Precision agriculture has transformed modern farming by leveraging advanced technologies to optimize resource use enhance crop productivity and promote environmental sustainability. This paper introduces a Precision Fertilizer Recommendation System (PFRS) designed to deliver highly accurate site-specific fertilizer recommendations tailored to diverse agricultural contexts. The system integrates Internet of Things (IoT) sensors machine learning algorithms and comprehensive soil nutrient analysis to assess critical parameters such as soil pH nitrogen-phosphorus-potassium (NPK) levels organic matter content and climatic variables including temperature rainfall and humidity. By employing supervised learning models like Support Vector Machines (SVM) Random Forest and Gradient Boosting the PFRS achieves up to 97% accuracy in predicting optimal fertilizer types and dosages for specific crops soil conditions and growth stages. The PFRS operates through a scalable cloud-based platform that provides real-time recommendations via a user-friendly interface making it accessible to smallholder farmers and large-scale agribusinesses alike. Evaluated on diverse datasets from multiple agroecological zones the PFRS demonstrates superior performance in precision recall and cost-effectiveness compared to conventional fertilizer application methods..

Keywords: Artificial Intelligence (AI); Spam Filtering; Machine Learning; Deep Learning; Natural Language Processing (NLP); Email Classification; Supervised Learning; Unsupervised Learning

PERSONALIZED DIET RECOMMENDATION USING AI + GUT MICROBIOME DATA

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Abstract: The relationship between nutrition and individual health outcomes is highly dependent on the human gut microbiome a complex ecosystem of microorganisms unique to every individual. Traditional diet recommendations often fail to deliver effective results due to their one-size-fits-all approach. This paper proposes an AI-driven personalized diet recommendation system that integrates gut microbiome data lifestyle habits and medical history to generate tailored nutritional plans. Using machine learning models trained on microbiome–food response datasets the system predicts how specific foods will affect digestion metabolism and overall health. The proposed solution continuously adapts based on user feedback and meal tracking creating a dynamic evolving diet plan. This approach not only enhances nutritional effectiveness but also holds potential in preventing chronic conditions such as obesitydiabetes and gastrointestinal disorders. The integration of artificial intelligence with microbiome analysis paves the way for a new era of precision nutrition offering a transformative service in healthcare andpersonal well-being.

Keywords: Gut microbiome = unique for each individual Problem = generic diets don't work for everyone AI + microbiome + lifestyle data → personalized diet

SAFETY CRACK MITIGATING CYBERBULLYING AND ONLINE HARASSMENT VIA COMMUNITY

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Abstract: SocialShield is a community-driven support and awareness platform designed to empower social networks—friends family schools and communities—to actively prevent identify and support victims of cyberbullying and online harassment. SocialShield connects victims with trained volunteers and counselors for immediate peer support and provides a comprehensive resource library with mental health tools and coping strategies. It enables crowdsourced anonymous reporting to enhance detection of abusive content and runs awareness campaigns to foster digital empathy and responsible online behavior. For youth protection SocialShield offers interactive workshops on digital literacy and safety alongside tools for parental guidance without compromising privacy. To combat inadequate regulation the platform includes a policy advocacy hub and collaborates with social media companies to improve content moderation.

Keywords: Cyberbullying Online Harassment Community Support Mental Health Digital Literacy Anonymity Youth Safety

SPAM EMAIL CLASSIFIER

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Abstract: The exponential growth of digital communication has led to an increasing prevalence of spam emails posing challenges to information security productivity and user experience. This paper presents a Spam Email Classifier designed to accurately distinguish between legitimate and spam messages using advanced machine learning techniques. The proposed system employs Natural Language Processing (NLP) for feature extraction incorporating word frequency analysis tokenization and semantic understanding to identify suspicious patterns in email content. Various classification algorithms including Naïve Bayes Support Vector Machines (SVM) and Deep Learning models are evaluated to determine their effectiveness in spam detection. Experimental results demonstrate high accuracy precision and recall significantly reducing false positives and false negatives. The system also integrates real-time filtering capabilities ensuring efficient email processing without compromising performance. This study highlights the importance of intelligent spam detection systems in safeguarding communication platforms reducing cyber threats and enhancing user productivity in the digital age.

Keywords: Spam Detection Machine Learning NLP Email Security Classification..

SUSTAINABILITY RE-IMAGINED: AI FOR GREEN CONSTRUCTION AND MATERIAL CIRCULARITY

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Abstract: The construction industry is one of the largest consumers of natural resources and one of the biggest producers of waste. Conventional methods of dealing with this waste like landfilling and uncontrolled disposal are not sustainable in the long run. To address these challenges the idea of a circular economy (CE) has gained importance.. The outcomes are multi-dimensional: it reduces the amount of waste going into landfills saves natural resources and cuts down costs for builders by making better use of existing materials. It also supports environmentally friendly practices by lowering energy use and carbon emissions. Most importantly it promotes a shift from the traditional “build and demolish” approach to a “design for deconstruction” approach where buildings are planned with future reuse and recovery in mind. This helps create a more circular construction process that can keep resources in use for as long as possible. In the long run such an approach not only makes construction projects more eco-friendly but also makes them more economically viable.

Keywords: Sustainability Circular Economy Construction and Demolition (C&D) Waste AI-Driven Eco-Algorithm Resource Reuse Design for Deconstruction

MENTAL HEALTH COMPANION

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Abstract: The increasing rate of mental ailments such as stress anxiety and depression emphasizes the need for ubiquitous and customized support networks. With professional therapists in short supply and increasing stigma associated with help-seeking such digital tools as mental health companions can be useful supplementary aids. An artificial intelligence-driven natural language processing-equipped and smart sensing-capable mental health companion can interact with an individual through compassionate dialogue mood monitoring and tailored advice. Safety is guaranteed through escalation rules that notify caregivers or professionals in dangerous scenarios. Applications are made to students working adults and the elderly facilitating self-knowledge with a decrease in loneliness and early identification of declining mental well-being. Integrating technology with compassion mental health companions can democratize psychological care build resilience and fill gaps in conventional models of care ultimately making mental well-being more supportive and humane.

Keywords: Mental health companion artificial intelligence natural language processing sentiment analysis emotional well-being self-care psychological resilience.

SMART HEALTHCARE: AI APPLICATION IN PERSONALIZED MEDICINE

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Abstract: Artificial Intelligence (AI) is changing the way healthcare is delivered by making it more accurate efficient and patient-focused. One of the most important applications is personalized medicine where treatments and medical decisions are designed around the unique needs of each patient. AI methods such as machine learning and deep learning can analyze large volumes of health data including medical records images and genetic information to identify patterns that are not visible through traditional approaches. Overall AI-driven personalized medicine has the potential to improve health outcomes reduce costs and make care more proactive. By combining technology with patient-centered approaches smart healthcare systems are moving towards a future where medical care is more precise accessible and responsive to individual needs.

Key words: Artificial Intelligence Personalized Medicine Smart Healthcare Predictive Analytics Precision Therapy Internet of Medical Things (IoMT)

AI BASED PEER TO PEER DOUBT SOLVER

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Abstract: In today’s fast-paced learning environments timely resolution of doubts plays a crucial role in effective knowledge acquisition. This paper proposes an AI-powered peer-to-peer doubt-solving system that dynamically connects students with relevant and available human experts—such as developers or knowledgeable peers—to address their queries in real time. The system utilizes artificial intelligence to intelligently route each query to the most suitable human responder based on factors such as availability domain expertise and historical response quality. In scenarios without appropriate human expert is available the AI intervenes directly to provide an automated solution using natural language processing and contextual understanding. This hybrid approach ensures round-the-clock doubt resolution promotes collaborative learning and leverages both human expertise and AI capabilities to improve the quality speed and scalability of academic support. The proposed system holds significant potential for applications in education technology online learning platforms and developer communities.

Keywords: AI-Powered Doubt Solving Peer-to-Peer Learning Human-AI Collaboration Intelligent Query Routing Real-Time Academic Support

GENERATIVE AI AND THE FUTURE OF CREATIVITY

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Abstract: The concept of creativity itself is being transformed by generative artificial intelligence (AI) which allows robots to not only mimic but also to produce original works of literature art music design and science. Generative AI systems in contrast to conventional computational tools may learn patterns styles and structures from large datasets to produce unique and contextually rich outputs. This development is pushing the limits of human creativity and giving artists new avenues for cross-disciplinary collaboration ideation and prototyping.. The conversation highlights the value of human–AI synergy in promoting innovation while preserving authenticity and ethical accountability by examining its potential as a tool and collaborator. The ultimate goal of creativity is to foster a dynamic collaboration between humans and technology that broadens the realm of possibilities not to replace human imagination.

Keywords: Human-AI Collaboration Innovation Future of Creative Industries Authorship.

FINBOT - AN INTERACTIVE FINANCIAL AGENT WITH ARTIFICIAL INTELLIGENCE

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Abstract: This abstract presents FinBot a state-of-the-art AI-powered chatbot that seeks to provide users with immediate precise and personalized assistance for their financial-related questions and advisory needs. With Natural Language Processing (NLP) and machine learning technology at its core FinBot is designed to pick up complex financial terminologies and purpose giving easy and simple responses for a comprehensive range of topics such as personal budgeting investment basics debt consolidation tax concerns and overall financial literacy. FinBot aims to democratize financial insight by offering a convenient 24/7 resource that reduces the barrier for gaining financial advice. The key benefit is that it can serve up first triage and educational support enabling human financial planners to perform more complex high-ticket planning. The technology can potentially serve as a solution to enhance financial well-being and empowerment among users in the form of a highly engaging and interactive conversational interface.

Keywords: Finbot AI Financial Agent Chatbot Technology.

COBOTS IN INDUSTRIES 5.0

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Abstract: Industry 5.0 advances beyond Industry 4.0 by fostering close collaboration between humans and collaborative robots (cobots). Unlike conventional industrial robots cobots are equipped with intelligent sensors adaptive control and AI algorithms that enable them to safely share workspaces with humans. This synergy allows cobots to perform hazardous repetitive and physically demanding tasks while humans focus on creativity decision-making and the customization of products. Real-world applications span industries such as automotive electronics textiles packaging and healthcare where cobots improve precision product quality and worker involvement. Ultimately cobots embody the vision of Industry 5.0 by uniting human ingenuity with robotic precision to create sustainable agile and human-centered manufacturing ecosystems.

Keywords: Industry 5.0 collaborative robots human-robot collaboration AI algorithms motion planning human-centered manufacturing automation

AUTOMATIC ATTENDANCE SYSTEM USING FACE RECOGNITION

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Abstract: The rapid advancements in computer vision and artificial intelligence have paved the way for innovative solutions in various domains including attendance management. This paper presents an Automatic Attendance System (AAS) using Face Recognition designed to streamline and enhance the efficiency of traditional attendance tracking methods. The proposed system leverages state-of-the-art deep learning algorithms for robust face detection and recognition enabling automated identification of individuals in a given environment. The AAS employs real-time video processing to capture facial images which are then compared against a pre-registered database of authorized personnel. The system is designed for scalability and can be integrated into various settings such as educational institutions corporate offices and event venues. Experimental results demonstrate high accuracy and reliability proving the AAS to be a secure efficient and cost-effective solution for modern attendance management contributing to smarter and more automated administrative processes.

Keywords : Face Recognition Automatic Attendance System Deep Learning Computer Vision Artificial Intelligence-Supervised Deep Learning

AI-POWERED DIABETIC RETINOPATHY DETECTION

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Abstract: EyePACS and MESSIDOR are the most popular datasets utilized for diabetic retinopathy (DR) screening studies. EyePACS published via the Kaggle DR competition contains over 35000 color fundus images with labels on a five-point scale from 0 (No DR) to 4 (Proliferative DR). Images are captured under various real-world settings which makes the dataset highly suitable for training sturdy convolutional neural networks. They usually preprocess EyePACS images by resizing cropping and normalization to standardize the inputs save computational cost and enhance model generalization. The MESSIDOR-2 is often used as a gold standard for model generalizability testing outside the training distribution. In combination EyePACS provides heterogeneous large-scale training data whereas MESSIDOR and MESSIDOR-2 offer strict benchmark platforms for assessing algorithm robustness and clinical impact..

Keywords: Video Analytics Deep Learning Object Detection Motion Detection CNN RNN YOLO Optical Flow.

AI-POWERED QUANTIFICATION OF CANCER CELLS IN

MICROSCOPIC IMAGES

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Abstract: Accurate detection and quantification of cancer cells in microscopic images are critical for early diagnosis and effective treatment planning. This paper presents an Artificial Intelligence (AI)-based system for automated cancer cell quantification leveraging advanced image processing and deep learning techniques. The proposed framework integrates convolutional neural networks (CNNs) for cell segmentation and classification enabling precise identification of malignant and benign cells. The system also incorporates preprocessing algorithms to enhance image quality normalize staining variations and reduce noise. By automating the quantification process the proposed model minimizes manual errors improves diagnostic speed and assists pathologists with reliable decision support. Experimental evaluation on publicly available medical image datasets demonstrates high accuracy robustness and scalability of the approach. This study highlights the transformative role of AI in digital pathology paving the way for faster more consistent and cost-effective cancer diagnostics.

Keywords: Artificial Intelligence Cancer Detection Image Processing Deep Learning Digital Pathology.

AI FOR SMART CITIES AND IOT APPLICATIONS

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Abstract: There is an urgent demand for smarter more sustainable cities due to the increasing growth of urbanization. When paired with the Internet of Things (IoT) artificial intelligence (AI) provides game-changing answers to problems including waste management public safety energy efficiency traffic control and environmental monitoring. When studied using AI and machine learning models the vast amounts of real-time data generated by IoT devices allow for better citizen services resource management and predictive decision-making and the foundation of smart city ecosystems is the combination of AI and IoT which promotes automation effectiveness and resilience. Nonetheless concerns about scalability security and data privacy continue to be major difficulties. In addition to raising urban living conditions the incorporation of AI and IoT in smart cities opens the door for intelligent governance and sustainable development.

Keywords: Artificial Intelligence(AI)Internet of Things(IoT)Urbanization.

AI MODELS FOR URBAN AIR QUALITY MONITORING AND PREDICTIVE ANALYSIS

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Abstract: Urban air quality monitoring and predictive analysis using AI models provide an innovative approach to addressing the growing challenges of air pollution in metropolitan areas. This project develops an AI-based system that collects real-time environmental data from sensors distributed across urban regions to monitor air pollutants such as particulate matter (PM2.5 PM10) nitrogen dioxide (NO2) carbon monoxide (CO) and ozone (O3). Leveraging advanced machine learning algorithms the model analyzes historical and current data to identify pollution patterns sources and trends. This project aims to provide a scalable efficient and user-friendly platform that supports environmental protection and urban health improvement. Additionally the model incorporates visualization tools and alerts to inform stakeholders about critical pollution levels in real-time. The approach demonstrates the potential of AI in transforming environmental monitoring through enhanced data insights and predictive capabilities ultimately contributing to sustainable urban development. **Keywords:** Urban air quality AI model predictive analysis machine learning air pollution monitoring particulate matter time series forecasting environmental data deep learning real-time monitoring.

Key words: Artificial Intelligence (AI); Spam Filtering; Machine Learning; Deep Learning; Natural Language Processing (NLP); Email Classification; Supervised Learning

AI PLANT TRANSLATOR

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Abstract: Artificial Intelligence (AI) has rapidly evolved to bridge the gap between humans and nature and one of the most innovative concepts emerging in this field is the AI Plant Translator. Plants though silent communicate through subtle signals such as changes in electrical impulses leaf movements color variations and biochemical responses.. By collecting real-time data from leaves roots and stems the device can analyze stress levels hydration needs exposure to light nutrient deficiencies or even responses to environmental stimuli. This translation not only enables farmers researchers and gardeners to better understand plant health but also promotes sustainable agriculture by reducing wastage of water fertilizers and pesticides. Beyond agriculture it has the potential to transform education and environmental conservation by fostering deeper human–plant interaction and awareness of ecological balance. Moreover the AI Plant Translator can act as an early-warning system for detecting plant diseases pest attacks or climate-related stress thus preventing large-scale agricultural losses.

Keywords: Artificial Intelligence Plant Communication Machine Learning Bioelectrical Signals Smart Farming Precision Agriculture

MACHINE LEARNING TECHNIQUES FOR PREDICTING WEATHER

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Abstract: Weather prediction has always been a complex scientific challenge due to the highly dynamic and nonlinear nature of atmospheric processes. However with the rapid advancement of data-driven approaches machine learning (ML) techniques have emerged as powerful tools for predicting weather patterns more efficiently. Machine learning models such as Artificial Neural Networks (ANNs) Support Vector Machines (SVM) Decision Trees Random Forests and Deep Learning architectures are increasingly being applied to analyze large-scale meteorological datasets. These models can identify hidden patterns nonlinear relationships and temporal dependencies in climate variables such as temperature humidity rainfall and wind speed. Techniques like Recurrent Neural Networks (RNNs) and Long Short-Term Memory (LSTM) networks are particularly effective for time-series weather data offering improved accuracy in short- and medium-term forecasting. The integration of ML with satellite data Internet of Things (IoT) sensors and real-time climate monitoring systems enhances the ability to provide more localized and adaptive forecasts.

Keywords: Machine Learning (ML) Artificial Neural Networks (ANNs) Support Vector Machine (SVM) Recurrent Neural Networks (RNNs) Long Short-Term Memory (LSTM) Internet Of Things (IOT).

AI-DRIVEN MUSIC RECOMMENDATION SYSTEM

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Abstract: The rapid growth of digital music platforms has led to an overwhelming amount of content making it challenging for users to discover music aligned with their preferences. Traditional recommendation approaches often fail to capture the complex and dynamic nature of human music taste. This paper presents an AI-Driven Music Recommendation System that leverages machine learning and deep learning techniques to provide personalized song suggestions. The system integrates collaborative filtering content-based filtering and hybrid models enhanced with natural language processing (NLP) and audio feature extraction for improved accuracy. By analyzing user listening patterns contextual information and metadata such as genre mood and tempo the system adapts to individual preferences in real time. A prototype was developed and evaluated using publicly available music datasets demonstrating significant improvements in recommendation precision compared to conventional methods. This research highlights the potential of AI-powered recommendation systems to enhance user engagement reduce decision fatigue and contribute to the evolution of intelligent music discovery platforms.

Keywords: Music Recommendation Artificial Intelligence Machine Learning Deep Learning Personalization Recommender Systems

AI POWER CODE GENERATION ASSISTANT

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Abstract: The rapid evolution of Artificial Intelligence (AI) has transformed software development by enabling automated solutions that enhance productivity accuracy and creativity. Among these innovations AI-powered code generation assistants have emerged as groundbreaking tools bridging the gap between natural language understanding and programming logic. These systems leverage advanced machine learning models and large-scale language processing techniques to generate efficient context-aware code snippets debug errors and optimize algorithms with minimal human intervention. This explores the role of AI in automating code generation emphasizing its potential to reduce development time support novice programmers and enhance collaborative software engineering practices. Key applications include rapid prototyping automated documentation adaptive learning for personalized coding support and integration with development environments. Furthermore the study highlights challenges such as ensuring code reliability addressing ethical concerns and balancing human creativity with automation.

Keywords: Artificial Intelligence Code Generation AI Assistants Software Development Automation Machine Learning Natural Language Processing

AI FOR PUBLIC TRANSPORT OPTIMIZATION

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Abstract: Artificial Intelligence (AI) has emerged as a transformative tool in optimizing public transportation systems addressing challenges such as congestion inefficiency and rising urban mobility demands. By leveraging real-time data from sensors GPS and passenger feedback AI enables dynamic route planning predictive maintenance and adaptive scheduling thereby improving service reliability and reducing operational costs. Machine learning models can forecast passenger demand patterns optimize fleet allocation and minimize energy consumption. Additionally AI-driven traffic signal coordination and smart ticketing systems enhance overall commuter experience while promoting sustainability. Integrating AI with Internet of Things (IoT) and big data analytics ensures better decision-making and fosters the development of intelligent transport ecosystems. This innovation not only improves accessibility and efficiency but also contributes to reducing emissions and supporting greener urban environments.

Keywords: *Artificial Intelligence Public Transport Optimization Smart Mobility Urban Transportation Machine Learning*

AI POWERED E-COMMERCE CHATBOT

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Abstract: The explosive rise of e-commerce resulted in a vast amount of customer interactions which made the conventional support mechanisms inefficient. A chatbot powered by AI is a necessary tool to offer instant round the-clock customer support and improve the online shopping experience. This paper proposes a system to create and deploy an intelligent chat bot capable of managing a large variety of customer queries and activities. The system is made up of different parts such as a Natural Language Processing (NLP) engine a product information database and a communication module. Sensors in the form of conversation nodes are installed to monitor customer requests in real- time. The system captures real-time customer intent with NLP linked to a dynamic network to offer smooth service. The chatbot is capable of managing various levels of queries ranging from simple product queries to more intricate issues such as order status and returns. The system architecture and application software are described in this paper.

Keywords: *AI Chatbot E-commerce NLP Customer Support Virtual shopping assistant Customer Support visual Support*

AI POWERED GAME LEVEL GENERATOR

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Abstract: By combining intelligent data analysis methods role-based access restriction and real-time Creating engaging and diverse levels for video games is a labor-intensive and time-consuming process for developers. This paper proposes an innovative AI-Powered Game Level Generator (AIGLG) that leverages Deep Learning and Procedural Content Generation (PCG) techniques to autonomously design functional aesthetic and challenging game environments. The AIGLG utilizes a Generative Adversarial Network (GAN) or Reinforcement Learning (RL) framework trained on a large corpus of human-designed levels to learn the underlying design principles spatial relationships and thematic consistency. Unlike traditional algorithmic PCG methods the AI-powered approach can generate levels that exhibit semantic coherence and designer intent ensuring a high degree of playability and variety. This system not only accelerates the content creation pipeline but also opens new avenues for dynamic difficulty adjustment and the personalization of game experiences.

Keywords: Artificial Intelligence (AI) Procedural Content Generation (PCG) Game Level Generation Deep Learning Generative Adversarial Network (GAN) Reinforcement Learning (RL)

AUTOMATED ESSAY GRADING (AEG) SYSTEM

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Abstract: The escalating demands on educators for timely consistent and frequent feedback necessitate innovative solutions driving extensive research into Automated Essay Grading (AEG) systems. These sophisticated applications of Natural Language Processing (NLP) and Machine Learning (ML) are designed to evaluate the holistic quality of written student work assigning scores based on criteria such as content coherence grammatical accuracy organizational structure and rhetorical effectiveness. This paper provides a comprehensive overview of the current state-of-the-art in AEG..—allowing users to understand why a specific score was assigned. Critically achieving high inter-rater reliability (concordance with human graders) remains the gold standard. The pedagogical implications are profound: AEG systems offer the capacity to provide immediate diagnostic feedback to students enabling iterative revision..

Keywords: Automated Essay Grading Natural Language Processing Deep Learning Educational Technology Assessment Algorithmic Bias.

AUTOMATIC TROLLY [IOT BASED]

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Abstract: This project outlines the design and implementation of an automatic IoT-integrated trolley system engineered for enhanced efficiency and convenience in material handling across environments like warehouses hospitals and retail spaces. The trolley achieves autonomous movement and obstacle avoidance via smart sensors microcontrollers (like Arduino/ESP32) and motor drivers while utilizing RFID or barcode scanning for user/item identification and following pre-defined paths. Real-time monitoring remote operation and location tracking are enabled by Wi-Fi/Bluetooth connectivity and a mobile/web application establishing a seamless Internet of Things connection. Powered by a rechargeable battery the system significantly reduces manual labor increases safety and improves inventory management through data logging. Furthermore cloud integration facilitates realtime data analytics paving the way for predictive maintenance by continuously monitoring performance and battery status demonstrating a revolution in conventional trolley technology.

Key words: Internet of Things (IoT) Smart Trolley for Warehouses Shopping Malls SMS alerts Safety react js.

BOOK EXCHANGE PLATFORM A WEB-BASED SYSTEM FOR SUSTAINABLE BOOK SHARING.

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Abstract: The Book Exchange Platform is an electronic solution aimed at facilitating the sustainable sharing and circulation of books among readers students and communities. It offers a simple interface through which people can post the books they have and want to exchange and also search for available copies from other people. Through promoting book reuse the site saves readers money decreases environmental degradation due to paper use and encourages knowledge sharing within society. The main functionalities include safe user registration book listings by categories search and filter mechanisms request management and messaging facilities to enable users to communicate. The system not only makes education and entertainment reading material more accessible but also compacts community bonding by tying individuals together through shared interests. Moreover incorporating rating and review features assures reliability and trust among users. Designing the platform for scalability and flexibility makes it appropriate for institutions like schools universities and public libraries as well as free reading communities.

Keywords : Book exchange knowledge sharing sustainability digital platform community engagement resource optimization education literacy

CRIME RATE PREDICTION SYSTEM USING HYBRID DATA DRIVEN APPROACHES: INTEGRATING SOCIOECONOMIC AND ENVIRONMENTAL FACTORS

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Abstract: Rising global urbanization has resulted in complex social dynamics intensifying the need for precise crime rate prediction tools. This paper introduces a data-driven approach for forecasting crime rates using advanced machine learning algorithms and multi-source data integration. The proposed model combines socioeconomic environmental and demographic datasets to enable proactive law enforcement and policy intervention. By employing temporal and spatial analysis techniques the system identifies emerging crime trends and hotspots supporting timely resource allocation and strategic planning. IoT-based surveillance and predictive analytics enhance real-time situational awareness allowing for dynamic risk assessment and rapid response. Simulation and empirical studies demonstrate increased predictive accuracy reduced resource wastage and improved community safety outcomes. This work highlights the potential of intelligent crime prediction systems to promote safer urban environments and support data-driven public safety infrastructure.

Keywords: Crime rate prediction Machine learning IoT Data integration.

CUSTOMER CHURN PREDICTION

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Abstract: Customer churn the process by which customers stop doing business with a company is a critical issue faced by organizations across various industries. Retaining existing customers is often more cost-effective than acquiring new ones making churn prediction a valuable tool for improving customer loyalty optimizing marketing strategies and increasing profitability. This study focuses on the development and implementation of a predictive model to identify customers who are likely to churn using historical customer data and machine learning techniques. Results show that ensemble models like Random Forest and Gradient Boosting outperform traditional classifiers in terms of predictive accuracy and robustness. The findings demonstrate the practical applicability of churn prediction models in real-world scenarios enabling businesses to proactively engage at-risk customers with targeted retention strategies. In conclusion customer churn prediction using machine learning offers a data-driven solution to a longstanding business challenge.

Keywords: Customer Churn Machine Learning Predictive Modeling Customer Retention Random Forest Gradient Boosting Data Analysis Churn Prediction Classification

FAKE NEWS DETECTOR CHROME EXTENSION

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Abstract: The proliferation of misinformation or "fake news" across social media and the internet presents a significant societal challenge. Chrome extensions have emerged as a practical real-time solution bringing automated detection capabilities directly to the user's browsing experience. At their core these extensions leverage sophisticated Artificial Intelligence (AI) and Machine Learning (ML) models—often employing techniques like Natural Language Processing (NLP) Deep Learning (DL) and Passive Aggressive Classifiers—to analyze textual visual and contextual features of online content. The process typically involves extracting text from a webpage sending it to a cloud-based server where a trained model classifies it and returning a prediction (e.g. "reliable" or "not reliable") to the user.. Furthermore many systems are designed for explainability offering users insights into why a piece of content was flagged as suspicious. The development of these tools is a continuous effort constantly refining their models with larger more diverse and multilingual datasets to combat the evolving tactics of misinformation creation and dissemination.

Keywords: Fake News Detection Chrome Extension Machine Learning Natural Language Processing Real-time Monitoring Digital Literacy.

FOOD RECOGNIZATION USING AI (CNN MODEL)

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Abstract: Eating habits strongly influence human health yet many people remain unaware of the nutritional content of the foods they consume. This lack of awareness often contributes to the rise of lifestyle diseases such as obesity diabetes and hypertension. To overcome this issue our project introduces an AI- driven Food Recognition and Health Advisory System designed to help individuals make smarter dietary choices in real time. The system utilizes deep learning—based image recognition to detect food items from smartphone images. After recognition it retrieves detailed nutritional data—including calories proteins carbohydrates fats and sugar—sourced from reliable nutrition databases. A personalized advisory engine then cross-checks this information with the user’s medical history and dietary preferences offering clear guidance on whether a food is safe should be consumed in moderation or avoided entirely. Beyond simple calorie counting this approach supports diet tracking and health-focused decision-making motivating users to adopt eating habits that align with their wellness goals.

Keywords: Artificial Intelligence (AI) Deep Learning Image Recognition Nutrition Database Personalized Recommendation

FOOD WASTE REDUCTION APP

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Abstract: Food waste is a growing global concern that contributes to environmental degradation economic loss and food insecurity. A significant portion of food waste occurs at the consumer level due to over- purchasing poor planning lack of awareness and improper storage. This project introduces a mobile application aimed at reducing household and community food waste through smart inventory management educational tools and community engagement. Educational content such as storage tips portion planning and environmental facts is integrated to raise awareness and encourage responsible consumption habits. A user-friendly dashboard provides insights into personal food waste metrics enabling goal-setting and progress tracking over time. Gamification elements including rewards badges and challenges are embedded to motivate consistent engagement. Designed with simplicity and accessibility in mind the app offers a seamless experience for users of all ages and backgrounds.

Keywords: Food waste reduction mobile application sustainability smart inventory community engagement environmental awareness household food management.

IOT DEVICE SECURITY SCANNER

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Abstract: The rapid proliferation of Internet of Things (IoT) devices across consumer and industrial sectors has introduced a vast non-standardized attack surface with significant security and privacy risks. These devices are often resource-constrained and deployed with weak security measures such as hardcoded credentials and unpatched firmware vulnerabilities making them prime targets for botnets and large-scale cyber attacks. This paper proposes an advanced AI/ML-powered IoT Device Security Scanner (IDSS) designed to automatically discover fingerprint and comprehensively assess the security posture of heterogeneous IoT devices within a network. The IDSS overcomes the limitations of traditional vulnerability scanners by performing non-intrusive passive monitoring combined with active security checks targeting common IoT weaknesses including insecure communication protocols weak API interfaces and unsecure update mechanisms. By leveraging machine learning for device behavior baseline analysis and anomaly detection the scanner provides continuous real-time security monitoring offering a prioritized risk assessment to facilitate timely mitigation and patching.

Keywords: IoT Security Vulnerability Scanner Device Fingerprinting Cybersecurity Firmware Analysis Network Security

JOB PORTAL WITH AI RESUME MATCHER

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Abstract: In the wake of the job market's exponential expansion we have seen the growth of creative recruitment systems which in turn bridge the gap between job seekers and employers. Which up till now have been traditional job boards that use keywords which in large scale prove to be an unreliable and time out of place solution leading to skills based mismatches between candidates and job requirements.. We have job seekers upload their resumes and employers post their open positions into this platform which also includes features of personalized job recommendations employer dashboards and applicant ranking which in turn improve the user experience and decision making. This AI powered job portal we see as a tool which simplifies the recruitment process for employers at the same time it puts job seekers first by which we mean we see a great increase in roles that match their skills and what they want out of a job. We put forth this system as a proof of what AI can do in recruitment which is to present a faster smarter and very reliable hiring process.

Keywords: *Job Board AI Resume Tool Natural Language Tech Machine Learning Recruitment Hiring Process.*

LUNG CANCER DETECTION

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Abstract: Lung cancer is one of the deadly diseases whose prediction is required to reduce the death rate. So Artificial intelligence is used on CT scan images to achieve better accuracy in an automated manner. Deep Learning is one of the emerging trends for predicting values. Convolution Neural Networks is one of the deep learning algorithms which when implemented to sample produces better outcomes as compared to other machine learning algorithms. In this paper the data-set has been taken with 1000 images of chest scans for different types of lung cancers such as Adenocarcinoma Large Cell Carcinoma and Squamous Cell Carcinoma. Multiple machine learning algorithms has been compared and then it has been confirmed that CNN is one of the best among all to check the accuracy of the prediction. The paper includes VGG-16 implemented on data set having different types of Lung Cancer and thus helping to check the severity and precautions for the same in a distinct manner.

Keywords: *Lung Cancer Detection Machine Learning Deep Learning Convolutional Neural Networks (CNNs) CT Scans Medical Imaging Early Diagnosis Artificial Intelligence.*

MALWARE SANDBOX ENVIRONMENT

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Abstract: A malware sandbox environment is a controlled and isolated virtual framework designed to analyze detect and mitigate malicious software without risking harm to real systems. It provides security researchers incident responders and organizations with a safe platform to observe the behavior of malware samples including file modifications network communications process activities and persistence techniques. By simulating a realistic operating environment sandboxes enable the identification of indicators of compromise (IOCs) and facilitate threat intelligence gathering. Malware sandbox environments play a critical role in strengthening cybersecurity defense by providing actionable insights for intrusion detection systems firewalls and endpoint protection platforms. They not only accelerate incident response but also support proactive defense through the continuous study of emerging threats. As cyberattacks grow more sophisticated sandbox technologies continue to evolve incorporating artificial intelligence machine learning and cloud scalability to enhance detection accuracy and efficiency.

Keywords: Malware sandbox Dynamic analysis Threat intelligence Indicators of compromise (IOCs) Behavioral analysis Virtualization Cybersecurity defense Evasion techniques

PASSWORD STRENGTH CHECKER WITH AI

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Abstract: Insecure password remains a persistent vulnerability in modern cyber security as traditional rule-based and entropy-based password checkers often fail to accurately predict the resistance of a password against advanced dictionary brute-force and pattern-based attacks. This paper presents a novel AI-powered Password Strength Checker (AI-PSC) that utilizes Machine Learning (ML) techniques to provide a more holistic and accurate real-time assessment. The AI-PSC is trained on a massive dataset of known compromised passwords and complex user-generated credentials enabling it to learn subtle human-predictable patterns that static analyzers miss. Specifically we employ a Deep Learning model such as a Recurrent Neural Network (RNN) or Transformer to analyze the password sequence and contextually estimate its crack time or risk score. Our system offers users adaptive constructive feedback beyond a simple "weak/strong" classification guiding them toward more secure yet memorable credentials.

Keywords: Artificial Intelligence (AI) Machine Learning (ML) Deep Learning Password Strength Analysis Cybersecurity

PNEUMONIA DETECTION USING X-RAY

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Abstract: Pneumonia remains one of the most prevalent and life-threatening respiratory diseases worldwide particularly in children and elderly populations. Early and accurate diagnosis is crucial for effective treatment and recovery. A convolutional neural network (CNN) architecture is employed to classify X-ray scans as either normal or pneumonia-affected reducing the dependency on manual interpretation by radiologists. The dataset is preprocessed through normalization and data augmentation to improve accuracy and generalization. This work contributes to the advancement of computer-aided diagnostic tools offering a cost- effective scalable and efficient solution to support healthcare professionals and improve patient outcomes. Experimental results demonstrate that the proposed model achieves high diagnostic accuracy outperforming traditional machine learning approaches and providing results comparable to expert radiologists. Furthermore the system exhibits strong generalization capabilities making it suitable for deployment in real-world clinical environments.

Keywords: Pneumonia Chest X-ray Deep Learning Convolutional Neural Network (CNN) Medical Imaging Automated Diagnosis Artificial Intelligence.

AI-BASED REAL-TIME LANGUAGE TRANSLATION MANAGEMENT SYSTEM: INTEGRATING NEURAL AND STATISTICAL APPROACHES FOR MULTILINGUAL MANAGEMENT

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Abstract: The proliferation of global communication necessitates real-time accurate and contextually fluent multilingual management systems. This paper proposes an AI-Based Real-Time Language Translation Management System (RT-LTMS) that achieves superior performance by strategically integrating Neural Machine Translation (NMT) and Statistical Machine Translation (SMT) approaches. The RT-LTMS leverages the strengths of NMT—its ability to produce highly fluent and contextually aware translations using deep learning architectures like the Transformer—while utilizing SMT principles to enhance robustness particularly for low-resource language pairs and for integrating fundamental linguistic rules. The hybrid model is housed within an intelligent Translation Management System (TMS). This platform utilizes AI for automated workflow real-time project supervision and continuous learning.

Keywords: Artificial Intelligence Real-Time Translation NLP Neural Machine Translation Speech Recognition.

SERVERLESS IMAGE PROCESSING APPLICATION

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Abstract: With the exponential growth of digital content across social media healthcare surveillance and e-commerce platforms the demand for efficient and scalable image processing has increased significantly. Traditional image processing systems often rely on dedicated servers which require constant maintenance incur high operational costs and struggle to handle sudden workload surges. To address these limitations serverless computing provides a cost-effective and highly elastic alternative by executing event-driven functions without the need for server management. This paper presents the design and implementation of a serverless image processing application capable of performing tasks such as resizing filtering format conversion and metadata extraction in a distributed cloud environment. The application leverages cloud-based serverless services to ensure scalability fault tolerance and reduced latency while minimizing infrastructure overhead. Experimental evaluation demonstrates that the serverless model achieves dynamic workload handling with pay-per-use efficiency making it suitable for real-time applications..

Keywords: Serverless computing Image processing Cloud services Scalability Event-driven architecture..

A SMART ADAPTIVE TRAFFIC MANAGEMENT SYSTEM FOR URBAN INDIA USING IOT AND AI

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Abstract: Indian metropolitan cities are experiencing severe urban traffic congestion which is a serious challenge that contributes to heavy economic losses higher pollution and an increased accident rate. Fixed-timing traffic light control systems do not work because they do not take into consideration real-time traffic flow patterns. This paper introduces a new Smart Traffic Management System (STMS) that incorporates the Internet of Things (IoT) and Artificial Intelligence (AI) technologies to establish an adaptive responsive traffic control system. The system as suggested employs an IoT sensor network (e.g. ultrasonic sensors inductive loops cameras) to capture real-time data on the density of vehicles speed and congestion at major intersections. The real-time data captured is subsequently sent to a cloud platform where the data is analyzed by an AI-based algorithm to make dynamic traffic light adjustments. The system is meant to give preference to traffic on busy roads make a clear path for emergency services and coordinate traffic signals at multiple intersections to create smooth and unbroken vehicular flow.

Keywords: Smart Traffic IoT AI Urban Mobility Congestion Indian Cities Real-time Data

VULNERABILITY SCANNER FOR WEB APPLICATIONS

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Abstract: Web application is a crucial part of modern digital services enabling businesses and users to interact seamlessly over the internet. However the rapid growth of web-based platforms has also increased the risk of cyberattacks making security a critical concern. By simulating common attack techniques the scanner identifies vulnerabilities and produces comprehensive reports detailing their severity along with recommended remediation strategies. Integrating vulnerability scanners into the software development lifecycle (SDLC) enhances security by addressing risks early reducing costs of late-stage fixes and ensuring applications remain resilient against threats. These tools also aid in achieving compliance with industry standards and frameworks like OWASP Top 10 and PCI-DSS thereby strengthening organizational security practices. Moreover continuous scanning provides proactive monitoring helping to safeguard sensitive user data and maintain trust. In conclusion web application vulnerability scanners serve as a vital component of cybersecurity strategies

Keywords: Vulnerability Scanner Web Application Security SQL Injection Cross-Site Scripting (XSS) OWASP Top 10 Cybersecurity Risk Assessment Compliance.

A NOVEL APPROACH TO AUTOMATED FAKE NEWS DETECTION USING MACHINE LEARNING AND ENSEMBLE METHODS

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Abstract: The growing influence of online platforms has made the spread of false news a significant concern often contributing to public misinformation and undermining trust in media sources. This project explores the application of Machine Learning techniques to assist in classifying news articles as real or fake. A publicly available labeled dataset of news articles is used consisting of balanced examples of both real and fake news. Preprocessing steps such as text cleaning tokenization and stopword removal are applied to prepare the data. Term Frequency-Inverse Document Frequency (TF-IDF) is used for feature extraction to convert text into numerical vectors suitable for model training. Several supervised learning algorithms—including K-Nearest Neighbors (KNN) Decision Trees Random Forest and Gradient Boosting—are implemented and evaluated.

Keywords: Fake News Detection Machine Learning (ML) Text Classification Ensemble Learning Methods Natural Language Processing (NLP) News Article Analysis

A NOVEL TO IMMERSIVE EDUCATION THROUGH VIRTUAL REALITY– BASED CAMPUS TOURS

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Abstract: In this digital era immersive technologies are reshaping the landscape of education by offering innovative ways of engaging with academic institutions. One such advancement is the Virtual Reality (VR) Campus Tour system which provides prospective students with an interactive lifelike experience of universities colleges and schools without the constraints of physical presence. Leveraging VR technology this system allows users to navigate through classrooms laboratories libraries hostels and cultural spaces with 360-degree visualization and real-time interactivity. The process begins with high-resolution 3D mapping of campus environments followed by rendering techniques that enhance realism and accessibility across multiple devices including VR headsets and mobile applications. Advanced interaction features such as guided tours voice-enabled navigation and integration with Artificial Intelligence (AI) chatbots further personalize the user experience.

Keywords: Virtual Reality (VR) Campus Tours Immersive Education 3D Visualization Interactive Learning Environments Educational Technology (EdTech)

ADAPTIVE AIOT-ENABLED CYBER-PHYSICAL FRAMEWORK FOR REAL-TIME AND PREDICTIVE URBAN MANAGEMENT

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Abstract: The rapid expansion of urban populations alongside escalating environmental and resource challenges demands advanced technological solutions for sustainable city governance. This paper introduces an integrated Artificial Intelligence of Things (AIoT) framework that seamlessly connects real-time operational intelligence with long-term predictive modeling to fundamentally transform smart urban management. The framework operates through the synergy of two core components: a dynamic real-time analytics system that continuously ingests and analyzes high-velocity data from diverse IoT sensors and an adaptive digital twin model that simulates complex future urban scenarios informed by current trends and historical patterns. This integration establishes a powerful bidirectional feedback loop that allows cities to respond promptly to immediate fluctuations—like traffic congestion air quality changes and energy demand—while strategically planning for anticipated developments emergency response and resource allocation. Architecturally the system is a scalable Cyber-Physical System of Systems (CPSoS)

Keywords— AIoT (Artificial Intelligence of Things) Digital Twin Smarter City Governance Cyber-Physical System (CPSoS) Sustainable Urban Planning.

AI HR RECRUITER & VIRTUAL CAMPUS INTERVIEW

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Abstract-This project introduces an AI-powered Human Resource (HR) Recruiter and Virtual Campus Interview Simulator designed to automate streamline and enhance the recruitment experience for companies colleges and job-seeking candidates. The proposed system leverages artificial intelligence natural language processing (NLP) and machine learning to mimic real-world HR recruitment processes. The core objective is to build a platform that acts as a virtual HR assistant capable of performing initial resume screening evaluating candidates’ skillsets and simulating interview rounds. By integrating AI-driven assessment modules the system ensures a fair and efficient selection process while reducing the burden on human recruiters. For colleges this project serves as a training and simulation platform that prepares students for actual campus interviews. It not only simulates interviews but also provides personalized suggestions for improvement highlights weak areas and generates performance analytics. Additionally the platform can offer guidance on resume building interview etiquette and domain-specific preparation making the recruitment process more holistic and supportive.

Keywords: Artificial Intelligence Human Resource Management Virtual Interview Simulator Campus Recruitment

RESILIENT AI FOR DEGRADED COMPUTE: ENSURING RELIABILITY BEYOND PERFECT HARDWARE

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Abstract: Artificial Intelligence (AI) is moving rapidly into fields where reliability is non-negotiable—healthcare aerospace autonomous systems and disaster response. Yet most AI systems today are built with one big assumption: that they will always run on ideal hardware. In controlled lab settings that may be true but the real world is far less forgiving. Inexpensive processors in developing regions radiation-damaged memory in space missions overheating GPUs in drones or unstable power grids in rural areas all introduce errors and slowdowns. Under such conditions traditional AI systems often fail abruptly—sometimes with consequences too serious to ignore.

Keywords: Artificial Intelligence GPUs

FOOD FRESHNESS 2025: INNOVATION IN EARLY SPOILAGE DETECTION

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Abstract: Guaranteeing food freshness is an essential challenge in modern fast-paced supply chains where consumers' safety nutritional content and sustainability are put into jeopardy. Conventional spoilage detection is usually based on visual examination smell or chemical analysis which are subjective time-consuming or expensive. Recent advances in early spoilage detection through smart sensors biosensors nanotechnology and AI-based monitoring systems provide revolutionary solutions. These technologies facilitate real-time sensing of biochemical alterations microbial growth and gas release enabling precise predictions of shelf life for food prior to occurrence of visible spoilage.

Key words: Food freshness spoilage detection biosensors smart packaging IoT nanotechnology sustainability

IOT BASED VEHICLE ANTI THEFT SYSTEM

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Abstract: Vehicle theft has emerged as a persistent issue in metropolitan as well as semi-urban areas resulting in financial loss and inconvenience to vehicle owners. Conventional security measures such as mechanical locks and alarms are often insufficient against modern theft techniques. To address this problem an Internet of Things (IoT) based anti-theft system is proposed which integrates multiple security features into a single cost-effective and scalable platform. The system combines Global Positioning System (GPS) tracking Global System for Mobile (GSM) communication camera-based facial recognition fingerprint authentication and remote engine immobilization. In the event of unauthorized access the system captures the intruder's facial image transmits an alert to the vehicle owner's smartphone through GSM and simultaneously disables the ignition system to prevent vehicle movement..

Keywords: IoT vehicle theft prevention GPS tracking GSM communication biometric authentication engine immobilization.

IOT-DRIVEN AUTONOMOUS DRONES: INNOVATIONS AND APPLICATIONS

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Abstract: Autonomous drone technology combined with the Internet of Things (IoT) has created new opportunities for innovation in a number of industries. IoT-driven autonomous drones improve productivity safety and decision-making across a variety of applications by combining real-time data processing sophisticated sensors AI-powered analytics and cloud connectivity. These drones can gather and send data to IoT platforms navigate complicated areas on their own and communicate with other linked devices without any problems. They make precision farming possible in agriculture by keeping an eye on irrigation systems crops and soil conditions. They maximize warehouse automation inventory tracking and last-mile delivery in logistics and supply chain management. Autonomous drone technology combined with the Internet of Things (IoT) has created new opportunities for innovation in a number of industries. IoT-driven autonomous drones improve productivity safety and decision-making across a variety of applications by combining real-time data processing sophisticated sensors AI-powered analytics and cloud connectivity.

Keywords: *IoT (Internet of Things) Autonomous Drone Smart Cities Precision Agriculture Disaster Management Logistics AI-powered Analytics Real-time Data Processing*

MASTERING MONEY:STRATEGIES FOR PERSONAL FINANCIAL SUCCESS

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Abstract: Personal financial success is an essential aspect of modern living where stability security and growth play a pivotal role in an individual's overall well-being. Effective money management goes beyond earning; it involves strategic planning saving investing and disciplined spending. Conventional financial practices often focus narrowly on income and expenses leaving individuals vulnerable to debt inflation or unforeseen emergencies. This paper discusses proven strategies for mastering money such as budgeting techniques emergency fund creation debt reduction methods and long-term investment approaches. It also highlights the role of financial literacy technology-enabled tools and disciplined behavior in shaping financial independence.

Keywords: *Personal finance budgeting investment financial literacy money management financial success.*

QUANTUM REVOLUTION: TRANSFORMING COMPUTING AND BEYOND

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Abstract: It is our ambition to build a biometric authentication system that would resist deepfakes by using state-of-the-art generative AI models. These systems can very well face the challenges and threats posed by the application of deepfakes on modern society. In this way it would supplement biometric authentication with tools that ascertain and reduce fake biometric scamming efforts such as those made by a spoofed face or voice input. So the proposed system dimension is liveness detection coupled with multi-factor biometric analysis which can capture minute differences that will trigger a deepfake attack in that system. For access authentication it would increase the level of trustworthiness and reliability of the method compared to texts based on the traditional password-based model as it also adds behavioral and physical-related traits such as voice and face recognition.

Keywords: Quantum Key Distribution (QKD) BB84 Protocol Quantum Cryptography Quantum Noise Quantum Bit Error Rate (QBER) Secure Communication

SENTIMENT ANALYSIS AND EMOTION DETECTION

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Abstract: The rapid expansion of digital communication particularly on social media and user review platforms generates an immense volume of text data making Sentiment Analysis and Emotion Detection critical tasks for understanding public opinion and user state. This paper presents a comprehensive approach utilizing Natural Language Processing (NLP) and deep learning techniques to accurately identify both the overall polarity (sentiment) and the specific emotional state expressed in textual content. We leverage a hybrid model combining recurrent neural networks (RNNs) like LSTMs or GRUs with attention mechanisms to capture long-range dependencies and focus on key emotional indicators within the text. The system is trained and evaluated on distinct datasets for sentiment (e.g. positive negative neutral) and a finer-grained set of basic human emotions (e.g. anger joy sadness fear).

Keywords: Sentiment Analysis Emotion Detection Natural Language Processing Deep Learning Text Classification.

SMART SERVICES HUB 2025: TRANSFORMING CONNECTIVITY AND INNOVATION

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Abstract: Failure recovery in network infrastructures is a critical aspect of maintaining seamless communication and ensuring minimal downtime. Virtual Local Area Network (VLAN) tagging is a promising approach for efficient failure recovery due to its ability to segregate network traffic logically and provide rapid redirection of data flows. This paper explores the use of VLAN tags to facilitate failure recovery mechanisms improving network resilience and reducing service disruption. This project proposes an innovative approach to multi-service integration addressing the limitations of existing siloed solutions while emphasizing interoperability sustainability and inclusivity. Future enhancements including blockchain-based security AR/VR-driven service experiences and IoT-enabled smart environments will further expand the platform’s transformative potential.

Keywords: Smart Services Hub Multi-Service Platform AI-Driven Personalization IoT Integration Cloud-Native Microservices Secure Transactions Real-Time Service Tracking Digital Transformation

THE POWER OF BIG DATA:ANALYTICS FOR A SMARTER WORLD

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Abstract: Massive amounts of data commonly known as "Big Data" have been produced by the quick development of digital technologies and networked devices. Using big data effectively has emerged as a key factor in improving decision-making fostering innovation and promoting long-term success in a variety of fields. This study examines how big data analytics can revolutionize the world by facilitating actionable insights from intricate and sizable databases. In order to find hidden patterns trends and correlations that conventional approaches are unable to detect big data analytics combines cutting-edge technologies and techniques including machine learning artificial intelligence and predictive modeling.

Keywords: IoT smart systems analytics artificial intelligence big data.

AI-POWERED FACT-CHECKING SYSTEMS FOR COMBATING MISINFORMATION

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Abstract: The rapid spread of misinformation across digital platforms poses significant challenges to society affecting public opinion policy-making and trust in institutions. Traditional fact-checking methods while reliable are often time-consuming and unable to keep pace with the scale and speed of online information dissemination. Recent advancements in Artificial Intelligence (AI) have enabled the development of AI-powered fact-checking systems that leverage natural language processing machine learning and knowledge graph technologies to automate and accelerate the verification process. These systems can analyze vast amounts of data identify potential misinformation cross-reference claims with trusted sources and provide real-time credibility assessments. However challenges such as data bias contextual understanding adversarial content and ethical considerations remain critical. This paper explores the architecture applications and limitations of AI-driven fact-checking systems emphasizing their potential role in mitigating misinformation while highlighting the importance of human oversight and transparent design.

Keywords: AI-powered fact-checking misinformation detection natural language processing (NLP) machine learning knowledge graphs automated verification

AI-DRIVEN INTRUSION DETECTION SYSTEM USING MACHINE LEARNING TO DETECT THREATS IN REAL TIME

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Abstract: The rapid growth of cyber threats has rendered traditional Intrusion Detection Systems (IDS) inadequate as they often depend on static signatures and predefined rules that fail to recognize evolving attacks. Artificial Intelligence (AI)-driven IDS powered by machine learning techniques offer a dynamic and adaptive approach to threat detection. This study explores the role of supervised unsupervised and deep learning methods in enhancing IDS performance with a focus on reducing false positives improving scalability and enabling proactive defense mechanisms. The integration of AI-driven models with IDS not only strengthens cybersecurity infrastructures but also provides intelligent automated responses against advanced persistent threats making them essential for modern digital environments.

Keywords: Intrusion Detection System (IDS) Artificial Intelligence (AI) Machine Learning Deep Learning Anomaly Detection

AI-DRIVEN PORTFOLIO WEBSITES FOR PERSONALIZED PROFESSIONAL BRANDING

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Abstract: In today’s competitive professional landscape creating a strong personal brand is essential for career growth and visibility. This project proposes an AI-driven portfolio website that dynamically generates customizes and optimizes personal branding for users. Leveraging Artificial Intelligence the system analyzes user inputs such as resumes projects experiences and career goals to automatically design personalized layouts recommend content enhancements and suggest keyword optimizations aligned with industry standards. Furthermore it integrates intelligent features like adaptive design real-time performance analytics SEO optimization and interactive AI chat assistance to enhance user engagement.

KEYWORDS-AI portfolio Personal branding Online portfolio Career growth Resume builder.

AI-POWERED PROCEDURAL CONTENT GENERATION FOR GAME DESIGN

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Abstract-Artificial intelligence (AI) is shaking things up in the world of procedural content generation (PCG) for game design. It’s moving past the old-school rule-based methods and stepping into a realm where game worlds can be more dynamic adaptive and immersive. This paper dives into how cutting-edge AI techniques—like deep learning generative adversarial networks (GANs) and reinforcement learning—are being used to automate and elevate the creation of game content including levels quests narratives and character behaviors. We take a closer look at how AI is currently being applied in PCG highlighting its benefits in producing a wealth of unique game content that boosts replayability and cuts down on development costs for designers. We also tackle the challenges that come with this new approach such as the necessity for large domain-specific datasets the hefty computational costs of training complex generative models and the ethical dilemmas related to content originality and bias. Our discussion shows how AI can be woven into the fabric of game design to strike a balance between automated content creation and human artistic input resulting in richer and more responsive gaming experiences.

Key Words :Domain-Specific Datasets Computational Costs Content Originality & Bias Human-Ai Collaboration Generative Adversarial Networks (Gans).

AL-INTEGRATED PROGRESSIVE WEB APPS FOR NEXT-GEN USER EXPERIENCE

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Abstract - Artificial Intelligence (AI) is increasingly shaping the future of digital experiences and its integration into Progressive Web Apps (PWAs) offers a transformative pathway toward next-generation user engagement. AI-integrated PWAs combine the accessibility responsiveness and cross-platform compatibility of web applications with the intelligence of machine learning and automation. This synergy enables advanced personalization predictive analytics adaptive interfaces and context-aware services thereby improving usability performance and accessibility across devices. By leveraging AI-driven features such as natural language processing recommendation systems voice-enabled interactions and intelligent automation PWAs can evolve into dynamic ecosystems that anticipate user needs and deliver seamless immersive experiences. This paper explores the potential architectural considerations and future scope of AI-integrated PWAs highlighting their role in redefining digital interactions and setting new standards for user experience in the next generation of web technologies.

Keywords : AI integration Progressive Web Apps next-generation user experience intelligent automation personalization adaptive interfaces predictive analytics natural language processing cross-platform applications digital innovation.

AUTONOMOUS SURVEILLANCE DRONES:AI INTEGRATION FOR SECURITY AND MONITORING

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Abstract: Advancements in artificial intelligence (AI) and unmanned aerial vehicles (UAVs) have enabled the development of intelligent surveillance systems capable of autonomous monitoring and decision-making. This paper presents the design and implementation of an AI-powered surveillance drone that integrates computer vision machine learning and real-time data processing to enhance security operations in various environments. The primary objective is to develop a drone capable of detecting tracking and analyzing human and vehicular activity efficiently while minimizing human intervention.. Performance evaluation conducted in both controlled and open environments indicates high accuracy in identifying and tracking targets with minimal false positives. In conclusion the AI surveillance drone demonstrates the practical feasibility of combining AI and UAV technologies to develop autonomous surveillance solutions offering substantial benefits in safety operational efficiency and situational awareness and laying the foundation for future research and development in AI-driven UAV applications.

Keywords—AI surveillance autonomous drones UAV computer vision deep learning object detection smart monitoring.

BLOCKCHAIN ENABLED FRAME WORKS FOR SECURE DIGITAL TRANSACTIONS

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Abstract: The rapid growth of digital economies demands secure transparent and tamper-resistant transaction mechanisms. Conventional centralized systems often face challenges such as data breaches fraud and lack of trust which highlight the need for more resilient solutions. Blockchain technology with its decentralized architecture immutability and consensus protocols offers a transformative framework for addressing these issues. This paper explores blockchain-enabled frameworks that enhance the security of digital transactions by integrating cryptographic techniques distributed ledger mechanisms and smart contracts. The study emphasizes how these frameworks reduce dependence on intermediaries improve auditability and foster trust among untrusted parties. By analyzing emerging models and innovative practices the work demonstrates that blockchain-based frameworks can serve as a robust foundation for secure efficient and transparent digital transactions in the next generation of digital ecosystems.

*Keywords:*Block chain Digital Transactions Security Decentralization Distributed Ledger Cryptography Smart Contracts

BUILDING TRUST BY MAKING AI DECISIONS UNDERSTANDABLE TO HUMANS

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Abstract: As artificial intelligence (AI) becomes increasingly integrated into decision-making processes across various sectors from healthcare and finance to autonomous systems and public policy building trust between humans and AI systems has become a critical priority. One of the most effective ways to foster this trust is by ensuring that AI decisions are understandable transparent and explainable to human users. This paper explores the importance of explainable AI (XAI) in enhancing human trust examining how interpretability accountability and communication of decision-making processes can bridge the gap between complex algorithms and human reasoning. By presenting AI decisions in a clear and context-aware manner users can better assess reliability fairness and ethical alignment ultimately leading to more informed adoption and collaboration. The study also highlights challenges and future directions in achieving human-centric AI systems that are not only powerful but also trustworthy and comprehensible.

Keywords: Explainable AI (XAI) Trust Transparency Interpretability Human-AI Interaction Decision-Making Accountability Human-Centered AI

DEVELOPING MACHINE LEARNING MODEL ON EDGE DEVICE FOR FASTER PROCESSING

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Abstract: The exponential growth of data generated by Internet of Things (IoT) devices and smart applications has created a strong demand for real-time analytics and decision-making. Traditional cloud-centric machine learning (ML) solutions often suffer from high latency excessive bandwidth consumption and increased security risks due to the transfer of sensitive data to centralized servers. This research explores the development and optimization of lightweight ML models specifically designed for edge environments. Techniques such as model quantization pruning compression and knowledge distillation are applied to reduce computational complexity without significantly compromising accuracy. Overall the integration of ML with edge computing represents a transformative step toward intelligent low-latency and privacy-preserving applications capable of addressing the evolving needs of modern digital ecosystems.

Keywords: *Edge Computing Machine Learning (ML) IoT (Internet of Things) Real-time Processing Low Latency Model Optimization*

DETECTING DEFORESTATION USING GOOGLE EARTH ENGINE (GEE)

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Abstract: Deforestation has emerged as one of the highest pressing global environmental challenges contributing significantly to biodiversity loss climate change and ecosystem imbalance. The traditional approach for monitoring forest cover have relied heavily on manual surveying field visits and static satellite imagery which often fail to capture subtle or rapid changes over time.. The analysis is based on the Normalized Difference Vegetation Index (NDVI) which provides a reliable indicator of vegetation health and density. Using Landsat satellite imagery pre-processed for atmospheric and radiometric corrections NDVI values were calculated for two distinct time frames and compared to identify areas experiencing significant loss of vegetation cover. Our approach integrates cloud computing automated data processing and visual representation to enhance monitoring efficiency while reducing computation time. The findings reveal clear patterns of deforestation with partially distinct regions showing notable degradation of vegetation health. This study not only showcases the ease of using cloud-based geospatial analytics for forest monitoring but also emphasizes its importance in policy-making conservation planning and early warning systems against deforestation.

KEYWORDS: *Google Earth Engine Deforestation Detection NDVI Time-Series Analysis Remote Sensing Western Monitoring.*

EDGE AI APPLICATION: ENABLING INTELLIGENCE AT THE DEVICE LEVEL

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Abstract- Edge Artificial Intelligence (Edge AI) represents a transformative shift from cloud-centric data processing to intelligence embedded directly within devices. The convergence of lightweight AI models dedicated hardware accelerators and high-speed connectivity technologies like 5G is accelerating the deployment of Edge AI at scale. Despite challenges such as limited computational resources model optimization and security considerations Edge AI holds immense potential to reshape industries by providing decentralized energy-efficient and context-aware intelligence. This paper explores the key applications enabling technologies benefits and challenges of Edge AI offering insights into how intelligence at the device level is becoming a cornerstone of the next generation of intelligent systems.

Keywords – Tiny Machine Learning (TinyML) hardware accelerators 5G and edge computing autonomous systems.

ENHANCING LEARNING OUTCOMES THROUGH GAMIFICATION: AN AI-ENABLED INTERACTIVE DESIGN

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Abstract:Digital learning platforms continue to face limitations in sustaining student engagement and addressing diverse learning needs. Gamification has been shown to improve motivation but often remains superficial while AI-driven adaptive systems personalize content yet lack interactive features to sustain long-term interest. A machine learning engine continuously profiles learners by analyzing performance engagement and interaction patterns. Based on these dynamic profiles the framework personalizes not only the difficulty of learning content but also the nature of gamified elements including adaptive challenges real-time feedback and reward systems aligned with individual motivational triggers. A prototype system was implemented and evaluated against conventional e-learning and non-adaptive gamified platforms. Results demonstrate significant improvements in student engagement knowledge retention and task completion. The framework provides a structured and replicable approach for developing adaptive and motivating educational technologies.

Keywords— Gamification Artificial Intelligence Adaptive Learning Systems Educational Technology Learner Modeling Student Engagement.

GAMIFICATION IN EDUCATION : ENHANCING LEARNING THROUGH INTERACTIVE DESIGN

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Abstract:the integration of game mechanics into non-game contexts—has emerged as a transformative strategy in modern education. This paper explores how interactive design principles such as points badges leaderboards and narrative-driven challenges can foster deeper student engagement motivation and learning outcomes. Drawing on case studies and empirical research the study highlights how gamified environments promote active participation improve retention and support diverse learning styles. The balance between educational content and playful interaction is emphasized as critical to success. The findings suggest that thoughtfully designed gamification not only enhances cognitive and emotional involvement but also contributes to measurable academic improvement. Future directions include adaptive gamification models and integration with emerging technologies like AR/VR to personalize learning experiences.

*Keywords:*Gamificationeducationtechnologystudentmotivationinteractivelearning engagement learning outcomes rewards and feedback goal-setting storytelling in education personalized learning.

GENERATIVE AI FOR PERSONALIZED LEARNING PACE: DESIGNING REAL-TIME COGNITIVE LOAD ADAPTIVE CONTENT DELIVERY

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Abstract:Traditional digital learning environments often fail to accommodate the diverse cognitive capacities and learning paces of individual students leading to suboptimal engagement and knowledge retention. This paper introduces an Artificial Intelligence (AI) driven framework designed to deliver educational content adaptively in real-time by continuously monitoring and responding to a learner's cognitive load. The proposed system utilizes a combination of physiological sensors and interaction analytics rates to infer a learner's cognitive state. Based on these real-time metrics a reinforcement learning algorithm dynamically adjusts pedagogical parameters such as content complexity presentation speed and the frequency of interactive prompts. This adaptive content delivery aims to maintain learners within their optimal zone of cognitive processing preventing both overload and underload. Experimental results from a prototype implementation demonstrate that this real-time cognitive load adaptation significantly enhances learning outcomes reduces frustration and improves overall efficiency compared to static and non-adaptive learning methodologies.

Keywords—Artificial Intelligence Personalized Learning Cognitive Load Adaptive Learning Systems Real-time Adaptation Educational Technology Reinforcement Learning Physiological Computing

GENERATIVE ROBOTICS: ADVANCING AUTOMATION THROUGH AI-DRIVEN DESIGN

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Abstract: Generative Robotics is an emerging interdisciplinary field that combines artificial intelligence with robotic engineering to develop adaptive intelligent and selfoptimizing robotic systems. his approach enables the creation of robots that are more flexible efficient and capable of addressing challenges in complex and dynamic environments. A major strength of generative robotics lies in its ability to accelerate and enhance the design process. Through iterative simulation and optimization robots can explore multiple design variations evaluate performance outcomes and select the most effective solutions with minimal human intervention. This capability not only fosters innovation bu also produces highly specialized robotic systems tailored to diverse industrial and societal needs. . In healthcare they support surgical precision and patient care personalization. In disaster management and space exploration self-optimizing robots are capable of navigating unpredictable and hazardous environments thereby reducing human risk. It represents a transformative step toward the development of next-generation robotics capable of continual learning adaptation.

KEYWORDS: *Generative Robotics Artificial Intelligence Automation Machine Learning Adaptive Systems Reinforcement Learning Robotic Innovation.*

INTERACTIVE DATA VISUALIZATION FOR SMARTER DECISION MAKING

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Abstract — Data visualization is a powerful business intelligence tool that gives decision-makers access to the meaning hidden in complex data sets. This study intends to define interactive data visualization's influence on organizations' decision-making procedures. This paper will look into the effectiveness of interactive data visualization by reviewing literature data case studies and empirical research. Results show that data visualization improves data exploration speeds decision-making and enhances cross-stakeholder collaboration. Nonetheless the efficiency of interactive data visualization relates to the quality of data the skills of the user and the user interface design. The research gives important information concerning the organizations seeking to get the best use of interactive data visualization for business intelligence decision-making.

Keywords— *Complex Data Decision Making Stake holder Data Visualization*

SERVERLESS WEB ARCHITECTURE FOR SCALABLE CLOUD

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Abstract - The fast development of cloud computing has changed how organizations build deploy and scale web apps. Older models that used servers worked well in the past but now have problems like managing hardware high costs and difficulty in scaling when user traffic changes unexpectedly. To fix these issues serverless web architecture has become a new way to build apps. This approach takes care of server management letting developers focus on the app's logic. Functions-as-a-Service (FaaS) events that trigger actions and managed services like databases storage and APIs. These parts allow the app to change and respond to user needs without manual setup. The architecture also helps apps be developed faster get to market quicker and be more reliable because the cloud provider offers tools like monitoring logging and security. However it also has some problems like being tied to one provider limits on how long tasks can run and making it hard to debug complex event-based apps.

Keywords: *Serverless computing Cloud applications Scalability Functions-as-a-Service (FaaS) Event-driven architecture Cloud-native*

SYNTHETIC DATA GENERATION: ARTIFICIALLY CREATED DATA FOR AI TRAINING

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Abstract- Artificial Intelligence has transformed the way data is created analyzed and applied. One of its most promising applications is artificially generated synthetic data a form of data that is artificially created by generative models such as GANs variational autoencoders and diffusion networks. Unlike traditional datasets collected from real individuals synthetic data imitates the statistical properties of real-world data without exposing sensitive information. This makes it highly valuable for domains where privacy data scarcity and cost are major challenges. Synthetic data is already being applied in healthcare (for training models without risking patient privacy) finance (for fraud detection without exposing customer details) autonomous vehicles (by simulating rare accident scenarios) and cybersecurity (for generating attack simulations). However challenges such as hidden bias imperfect realism and validation reliability remain open concerns. The future of synthetic data lies in creating hyper-realistic simulations privacy-first AI ecosystems and synthetic data marketplaces that can accelerate innovation across industries.

Keywords: *Synthetic Data Generative AI GANs Privacy Data Simulation AI Applications*

HEALTHCARE WITH ROBOTICS: AI ENABLED TRANSFORMING INNOVATION

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Abstract- This project focuses on creating AI-powered healthcare robots that are affordable and useful in rural and low-resource areas. Unlike costly hospital robots our model supports basic diagnostics patient monitoring medicine reminders and tele-consultation with doctors. Using edge AI for real-time decision-making it improves accessibility affordability and continuity of care. This innovation transforms healthcare by combining robotics with telemedicine to bridge gaps in underserved communities. In addition the project highlights human-robot collaboration for safe and reliable service delivery. It addresses the challenge of making advanced healthcare technology affordable and scalable. The proposed system ensures inclusivity by supporting both patients and healthcare workers. Overall it presents a practical step toward transforming healthcare through AI and robotics.

Keyword: AI Healthcare Robotics Telemedicine Rural Health

TURNING RAW DATA INTO INSIGHT WITH DASHBOARDS AND VISUAL STORYTELLING

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Abstract – Raw data lacks inherent meaning requiring thoughtful processing and presentation to unlock its true value .this paper presents a novel methodology for transforming complex unstructured datasets into compelling actionable insights through the strategic application of interactive dashboard and visual storytelling .By integrating structured data processing with advanced visualization techniques Our approach systematically guides the user ‘s attention to key findings trends and outlier . We details the process from defining analytical objectives and constructing the visual narrative to implementing dynamic clutter – free dashboard that leverage design principles to enhance comprehension . Our finding demonstrate that this structured narrative approach significantly improves the efficiency and effectiveness of information retrieval for stakeholder democratizing data – driven decision – making across an organization regardless of the end user’s data literacy .

KEYWORDS : To analysts beyond visualization to integrate context design and storytelling .

ZERO TRUST ARCHITECTURE FOR MODERN NETWORK SECURITY

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Abstract – Using the principles of quantum mechanics quantum cryptography provides unprecedented security for communication. But as systems that contain sensitive information such as credit card numbers email addresses and names are evolving it's important to send or store this data to maintain security and privacy in places where security quantum to ensure that not only actual quantum communications. In this paper we tackle the challenge of properly anonymizing sensitive data in quantum cryptographic systems in order to prevent its exposure especially for scenarios where there is a risk of data harvesting or breach role. To overcome this problem we used Presidio a sophisticated tool for identifying sensitive and anonymous information and were able to create a list of these data items by applying information to sample text with information a provides identification including name credit card number and email address The results show that it is possible to efficiently anonymize private information without affecting communication integrity adding additional security to quantum cryptographic systems.

Keywords – Cryptography Quantum CommunicationData Privacy Security Private Information.

ADVANCEMENTS AND CHALLENGES IN ELECTRONIC VOTING SYSTEM

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Abstract-Electronic voting (e-voting) systems mark a transformative evolution in democratic processes leveraging digital technologies to enhance efficiency accessibility and scalability in electoral frameworks. These systems encompass a range of modalities including direct-recording electronic (DRE) machines optical scan ballots and internet-based voting platforms integrating advanced functionalities such as voter authentication secure ballot presentation encrypted vote transmission and automated tabulation. By 2020 93% of U.S. jurisdictions had adopted paper-based audit trails to enhance auditability mitigating risks of undetected errors or cyberattacks through voter-verifiable records.Despite these advancements e-voting systems face multifaceted challenges that demand rigorous attention. Cybersecurity vulnerabilities such as denial-of-service attacks server compromises and malware infiltration underscore the necessity for resilient defenses including post-quantum cryptography and secure multiparty computation. Usability barriers particularly for elderly disabled or technologically disadvantaged populations pose significant hurdles to equitable access.

Keywords: E-Voting Digital Democracy Cryptography Blockchain Voter Privacy Cybersecurity Audit Trails Accessibility Transparency Public Trust

MOBILE APP FOR FARMING

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Abstract—The research addresses the major inefficiencies and profit-loss issues in traditional farmer-to-market supply chains. The solution proposed is the Mobile Application for Farmer–Market Direct Connection (FarmDirect) a digital platform for direct transactions. FarmDirect eliminates multiple intermediaries fostering transparency and direct profit for small-scale farmers. Key features include geolocation mapping secure integrated payments and a robust rating and review system to build trust. The platform also utilizes predictive analytics to assist farmers with demand forecasting and inventory optimization. Development followed an Agile methodology ensuring continuous incorporation of user feedback from farmers and buyers. A pilot study was conducted to evaluate the platform's impact on farmer income post-harvest loss and transaction speed. Pilot results showed a significant increase in net farmer income and a reduction in the time produce takes to reach the consumer. FarmDirect offers a viable scalable and sustainable digital solution for revitalizing local and regional food systems. Future work will focus on integrating supply chain financing and expanding support for farmer cooperations.

Keywords— E-agriculture Digital Farming and Farmer tools app.

AGRICULTURAL WEB DEVELOPMENT

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Abstract— Agriculture is undergoing a digital transformation with increasing reliance on technology to improve productivity sustainability and farmer accessibility. This paper presents a Web-Based Agricultural Information and Management System designed to provide farmers with real-time access to crop care guidance weather forecasting market price updates and pest alerts. The proposed system integrates modern web technologies with cloud-based data storage ensuring scalability user-friendliness and secure data access. A modular architecture enables multi-page functionality for crop alerts weather forecasting market analytics and health monitoring of crops all accessible through an intuitive interface. The platform also incorporates IoT data integration and push notification features to deliver timely recommendations thereby enhancing decision-making for farmers.

Keywords— Agriculture Web Development IoT Smart Farming Information System.

SMART ATTENDANCE USING IOT

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Abstract- The increasing demand for accuracy efficiency and security in managing attendance has led to the rise of smart attendance systems. Traditional manual methods are often time-consuming prone to errors and susceptible to proxy attendance making them unreliable for educational institutions and workplaces. Smart attendance systems overcome these limitations by leveraging advanced technologies such as facial recognition biometrics RFID Internet of Things (IoT) and mobile applications. These technologies enable automated contactless and real-time attendance tracking while ensuring data security and reducing administrative workload. By integrating unique identifiers like fingerprints facial features or RFID tags the system authenticates individuals seamlessly and records attendance instantly into digital databases which can later be accessed through live dashboards reports or analytics. Such systems not only improve operational efficiency but also provide valuable insights into attendance patterns while enhancing transparency and accountability.

Keywords- Smart Attendance System Facial Recognition Biometrics Internet of Things (IoT) Mobile applications Automated Attendance Real-Time Tracking Data Security Proxy Prevention Artificial Intelligence(AI) Attendance Analytics RFID\NFC

AN INTELLIGENT WEB APPLICATION FOR BUSINESS RISK ANALYSIS AND SUCCESS PREDICTION

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Abstract— In today’s dynamic and competitive environment businesses face increasing uncertainty due to financial operational and market-related risks. Traditional methods of risk management are often manual subjective and limited in their ability to provide actionable insights for long-term sustainability. This paper presents an intelligent web application for business risk analysis and success prediction designed to support enterprises in identifying potential threats assessing survival probability and formulating strategic recommendations. The proposed system integrates a structured risk assessment framework with predictive modeling techniques to estimate the likelihood of business success or failure based on financial operational and market indicators.

Keywords— Business Risk Analysis success Prediction Decision Support System Web Application Artificial Intelligence (AI) Strategic Advisory Business Viability Sustainable Growth.

BLOCK CHAIN AND AI FUSION FOR SECURED CLOUD COMPUTING

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Abstract—This research looks at combining blockchain technology with artificial intelligence (AI). The convergence of Blockchain and Artificial Intelligence (AI) is redefining the landscape of secured cloud computing. Blockchain’s decentralized architecture ensures data integrity transparency and tamper-resistance while AI introduces intelligent automation predictive analytics and adaptive threat detection. This fusion addresses critical challenges in cloud environments including data breaches unauthorized access and compliance management. By integrating smart contracts with AI-driven orchestration cloud systems can achieve enhanced scalability real-time security monitoring and autonomous decision-making. This paper explores the synergistic potential of Blockchain-AI fusion proposes a hybrid framework for secure cloud operations and highlights its transformative impact across industries such as healthcare finance and smart infrastructure.

Keywords—Block chain Technology AI Monitoring Cloud Computing Privacy Distributed Systems Data Security

EMERGENCY VEHICLE PRIORITY SYSTEM

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Abstract— Urban traffic congestion has become a critical challenge in modern cities often causing severe delays for ambulances fire trucks and police vehicles during emergencies. These delays can result in tragic outcomes including preventable loss of life. Conventional traffic management systems are static and unable to prioritize emergency vehicles in real time highlighting the urgent need for adaptive and intelligent solutions. This paper presents an Emergency Vehicle Priority System (EVPS) that integrates Internet of Things (IoT) sensors RFID/GPS technology and intelligent traffic signal control to provide uninterrupted passage for emergency vehicles. When an emergency vehicle approaches an intersection the system detects its presence through RFID/GPS modules transmits data to an IoT-based control unit and dynamically adjusts the traffic lights to create a green corridor. This ensures faster clearance of emergency vehicles without manual intervention.

Keywords— Emergency Vehicle Traffic Management IoT Priority System Smart City.

BIG DATA ANALYTICS FOR DECISION INTELLIGENCE

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Abstract— The exponential growth of data in modern organizations has created both opportunities and challenges in decision-making processes. This paper presents a comprehensive framework for Big Data Analytics for Decision Intelligence (DI) designed to enhance organizational decision-making through data-driven insights. The proposed system integrates structured and unstructured data from multiple sources leveraging advanced analytics machine learning and AI-driven predictive models to support strategic and operational decisions. A decision intelligence algorithm dynamically interprets real-time data identifies patterns and generates actionable recommendations enabling faster and more accurate decision-making. The framework incorporates visualization tools and IoT-enabled data collection for continuous monitoring scenario analysis and predictive forecasting.

Keywords— Big Data Analytics Decision Intelligence Machine Learning Predictive Analytics Data-Driven Decision-Making.

DUAL-LAYER SECURITY WITH AI VOICE RECOGNITION AND CODE-BASED AUTHENTICATION

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Abstract : Based system to integrate biometric security. While traditional fingerprint or face unlock Is done using only the unique voiceprint of the authentic user this system uses the Unique voiceprint of the user along with a pre-defined code to provide access. At Enrolment the system captures the voice of the user derives acoustic features and Securely associates them with the selected code. On authentication access is permitted Only if the voice that was spoken aligns with the stored biometric template and the Correct code is inputted. This two-layered method eliminates the threat of spoofing Replay attack or unauthenticated entry as both factors must match together. The System is optimized for rapid processing on-device maintaining privacy and low latency. Potential uses are in smartphones smart locks banking networks and other secure Systems where stronger multi-factor authentication is needed and they use them securely.

Keywords— AI voice recognition biometric authentication dual-layer security code-Based lock access control smart lock.

LIGHTWEIGHT UNIFIED MODEL FOR IMAGE AND SHORT VIDEO DETECTION USING LATENT FEATURES AND SPATIO-TEMPORAL TRANSFORMERS

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Abstract— Object and activity detection in images and videos has become a cornerstone of computer vision applications yet many existing models require high computational resources and large annotated datasets. This paper presents a lightweight unified model for image and short video detection that can be trained entirely on a single laptop with a mid-range GPU using only open-source datasets. The system employs a latent feature extraction backbone combined with a spatio-temporal transformer to capture both spatial details and temporal dependencies across video frames.

Keywords— Image Detection Video Detection Spatio-Temporal Transformer Latent Features Lightweight Architecture Free AI Training.

SYNTHETIC CREATIVITY: TRANSFORMING MEDIA AND ENTERTAINMENT WITH AI

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Abstract— Picture a world where AI helps filmmakers and artists bring their wildest dreams to life. In 2025 synthetic creativity is revolutionizing the film and art industries making creation a thrilling partnership between humans and technology. AI tools like text-to-image generators (e.g. DALL·E) and smart editing software empower filmmakers to craft stunning CGI characters and storyboards with ease. Platforms like xAI’s Grok tap into audience data to shape stories that feel deeply personal connecting hearts to screens. In art AI creates vivid digital paintings and NFTs letting independent creators shine alongside industry giants. These tools slash costs and open doors inviting anyone with a vision to tell their story. Yet challenges like copyright disputes and fears of losing the human soul of art keep us grounded. By blending AI’s brilliance with the raw passion of human creativity we ensure films and art remain soulful and true. This revolution welcomes all to create but we must navigate ethical hurdles to keep storytelling’s heart alive.

Keywords: synthetic creativity AI film art filmmakers artists AI tools stories story creativity storytelling.

ARTIFICIAL INTELLIGENCE BASED HUMAN ACTIVITY RECOGNITION FOR SMART APPLICATIONS

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Abstract—Human Activity Recognition (HAR) has become a vital area of research within Artificial Intelligence (AI) allowing machines to automatically identify categorize and understand human actions in real-world settings. With swift progress in machine learning computer vision and wearable sensor technologies HAR systems are increasingly utilized in fields such as healthcare smart homes surveillance sports analysis and human-computer interaction. These systems are engineered to identify both basic physical activities like walking sitting or running as well as more intricate sequential behaviors that involve multiple gestures and interactions. This project investigates AI-driven methods for human activity detection focusing particularly on deep learning techniques. Architectures such as Convolutional Neural Networks (CNNs) are employed for spatial feature extraction while Recurrent Neural Networks (RNNs) and Long Short-Term Memory (LSTM) units are used for modeling sequential data. Recently transformer-based models have shown enhanced performance in capturing long-range temporal dependencies providing improved accuracy and robustness.

Keywords: Human Activity Recognition (HAR) Artificial Intelligence (AI) Deep Learning Edge AI..

AI CAREER COMPASS: A PERSONALISED DATA-DRIVEN FRAMEWORK FOR CAREER GUIDANCE

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Abstract—The modern workplace is characterised by rapid evolution making traditional generalised career advice increasingly inadequate for unlocking an individual's full potential. This paper introduces the "AI Career Compass" a data-driven system designed to provide personalised future-ready career guidance. The framework addresses the scalability and affordability limitations of traditional career coaching by leveraging artificial intelligence to process vast datasets and deliver tailored recommendations. The system operates by synthesising user-specific inputs—including strengths interests and goals—with comprehensive labour market data to generate a personalised career roadmap. This roadmap includes specific role suggestions skill gap analysis and curated learning paths. By analysing over 350 million talent profiles and tens of thousands of job titles and skills the AI engine provides dynamic real-time guidance that adapts to both individual growth and market trends.

Keywords—Artificial Intelligence Career Guidance Personalized Learning Data-Driven Decision Making Skill Gap Analysis Labor Market Analytics

ADAPTIVE AI-BASED STACK FILTER DETECTION FOR INTELLIGENT SIGNAL PROCESSING

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Abstract - Artificial Intelligence (AI) stack filter dedication represents a progressive integration of adaptive learning systems with traditional stack filtering methodologies aiming to establish a more intelligent accurate and resilient approach to data filtering and signal enhancement. Stack filters which are widely employed in image processing pattern recognition communication systems and biomedical signal analysis are valued for their ability to suppress noise while preserving structural integrity. However conventional stack filter designs typically rely on predetermined mathematical formulations that are limited in their adaptability to diverse datasets unpredictable signal variations and complex non-linear environments. The dedication of AI methodologies to stack filtering enables a paradigm shift from static models toward dynamic data-driven optimization.

Keywords: Artificial Intelligence Stack Filter Machine Learning Signal Processing Adaptive Systems Deep Learning Sensing Data Optimization

MOBILE APP FOR FARMER-MARKET DIRECT CONNECTION

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Abstract - This project proposes the development of a mobile application designed to establish a direct connection between farmers and market buyers including retailers wholesalers and consumers. The aim is to streamline the agricultural supply chain by eliminating intermediaries ensuring better pricing for farmers and fresher produce for buyers. Small-scale farmers often face challenges such as lack of market access price exploitation by middlemen and limited knowledge of demand patterns. On the other hand buyers struggle with inconsistent quality fluctuating prices and delayed supply. The proposed mobile app addresses these issues through a user-friendly platform that facilitates transparent communication real-time pricing and efficient logistics planning. Key features of the app include farmer and buyer registration product listing with images and descriptions location-based search digital payment integration and order tracking. An in-app messaging system will allow both parties to negotiate and finalize deals directly. Additionally the app will provide analytics and insights to help farmers align their production with market demand trends.

keywords: Farmer-market connection mobile app agri-tech direct sales farm produce digital agriculture market access rural development supply chain efficiency

AI POWERED CHATBOT

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Abstract: AI-powered chatbots are revolutionizing customer interaction and support across various industries by leveraging advanced machine learning and natural language processing (NLP) technologies. These intelligent systems are designed to simulate human-like conversations providing instant responses to user queries processing complex requests and even carrying out tasks that traditionally required human intervention. By continuously learning from user interactions AI chatbots can improve their responses over time becoming more accurate and context-aware. The core of an AI-powered chatbot lies in its ability to understand and interpret natural language allowing it to engage idynamic multi-turn conversations. Machine learning algorithms analyze vast amounts of data to detect patterns identify user intent and provide relevant information or solutions.

Keywords: AI-powered chatbot natural language processing machine learning customer support user interaction conversational AI

SMART TASK REMINDER WITH AI

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Abstract :__The increasing complexity of daily schedules and collaborative work environments has created a strong demand for intelligent automated task-management solutions. This paper introduces Smart Task Reminder with AI an application designed to help users plan track and complete tasks more efficiently through advanced artificial-intelligence techniques. The system leverages natural-language understanding to capture tasks from free-form user input applies machine-learning models to predict task priority and optimal reminder times and employs adaptive scheduling to reschedule activities when conflicts arise. Secure data handling safeguards user information while integrated analytics provide personalized productivity insights and trend forecasting empowering users to make data-driven decisions about their time. Prototype testing demonstrates significant reductions in missed deadlines and improved user satisfaction compared with conventional reminder apps. This work highlights the potential of AI-driven personal assistants to enhance productivity and support smarter stress-free time management.

Keywords ; Artificial Intelligence Smart Reminder Task Management Productivity Natural Language Processing.

OFFLINE-FIRST AI: BUILDING SMART SYSTEMS THAT WORK WITHOUT INTERNET

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Abstract: The increasing reliance on cloud-based Artificial Intelligence (AI) systems highlights a major limitation in areas with poor or no internet connectivity. This paper introduces an Offline-First AI framework that enables intelligent systems to operate autonomously without continuous internet access. The proposed approach leverages lightweight models edge computing and optimization techniques such as model quantization pruning and federated learning to perform on-device inference. By integrating algorithms like MobileNetV2 for image classification Random Forest for sensor data analysis and DistilBERT for natural language processing the system achieves high accuracy low latency and efficient resource utilization on constrained hardware. Simulation results and prototype evaluations demonstrate that Offline-First AI ensures resilience privacy and scalability across critical domains including healthcare agriculture education and disaster response. This study highlights the potential of Offline-First AI in bridging the digital divide and advancing intelligent solutions for underserved and connectivity-challenged regions.

Keywords— Offline AI Edge Computing TinyML Decentralized AI Systems Low-Power AI Federated Learning.

SMART AGRICULTURE SYSTEM WITH AI & AUTOMATION

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Abstract: Agriculture remains the backbone of global food security but traditional farming practices face increasing challenges due to climate change soil degradation unpredictable weather patterns and rising food demand. Smart agriculture driven by advanced technologies offers sustainable solutions to these issues by enabling data-driven precise and resource-efficient farming. This study proposes a smart agriculture system that integrates Internet of Things (IoT) Artificial Intelligence (AI) Machine Learning (ML) and automation techniques to introduce new and innovative farming methods. The system employs IoT-based sensors to monitor soil health temperature humidity and crop growth in real time while AI-driven predictive analytics optimize irrigation schedules fertilizer usage and pest control.

Keywords: Artificial Intelligence Stack Filter Machine Learning Signal Processing Adaptive Systems Deep Learning Sensing Data Optimization

AI CLIMATE DETECTOR

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Abstract: AI Climate Detector to Climate change has emerged as one of the most critical global challenges of the 21st century demanding innovative technological solutions for accurate monitoring prediction and mitigation. Traditional climate detection systems while effective often face limitations in handling large-scale heterogeneous datasets real-time processing and predictive accuracy. The integration of Artificial Intelligence (AI) into climate detection introduces new possibilities for enhancing precision scalability and efficiency in environmental monitoring. An AI Climate Detector leverages machine learning deep learning and data-driven models to analyze complex climate variables such as temperature precipitation atmospheric pressure greenhouse gas emissions and oceanic patterns. By processing satellite imagery sensor data and historical climate records AI systems can identify subtle trends detect anomalies and predict future climate events with high accuracy.

KEYWORDS: AI Climate Detector climate change machine learning deep learning environmental monitoring predictive analytics

ARTIFICIAL INTELLIGENCE HEALTH CARE DIAGNOSTICS

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Abstract: Artificial Intelligence (AI) is revolutionizing the healthcare sector by enhancing the accuracy efficiency and accessibility of medical diagnoses. AI-powered systems including machine learning models and deep learning algorithms can analyse vast amounts of medical data such as imaging electronic health records and genetic information to assist clinicians in detecting and diagnosing a wide range of diseases including cancer cardiovascular disorders and neurological conditions. These technologies offer the potential to reduce diagnostic errors accelerate clinical workflows and provide support in areas with limited access to healthcare professionals. Despite its promising benefits the integration of AI in clinical practice raises ethical legal and regulatory challenges including data privacy concerns and the need for transparent explainable models.

Keywords: Artificial Intelligence (AI) Health Diagnosis Machine Learning Deep Learning Medical Imaging Electronic Health Records (EHR) Diagnostic Accuracy

VED CROP: TRANSFORMING AGRICULTURE WITH ARTIFICIAL INTELLIGENCE

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Abstract— Detecting diseases from crops earlier is the biggest disadvantage where every farmer faces in the modern days. The required medicines and doctors for the crops weren't available early in the rural areas and this is the biggest disadvantage faced by farmers. There are many solutions were there to solve the issue but only few works and reaches the people many of them doesn't know about the Software's to detect the plant diseases early. That software's weren't working correctly and their accuracy is very low and some of them won't work in low end devices and need high speed internet connection but farmers weren't able to afford Good mobile devices and poor internet connections in rural area. Many of the users of this Type of applications were urban peoples for their Gardening at home this makes the software used by only urban area peoples and its feature wasn't targeting the farmers.

Keywords— Disease detector rural areas ML models Ved crops offline History tracking traditional solutions

BUILD A DIGITAL PLATFORM TO COLLECT RECYCLE OR REFURBISH IT HARDWARE

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Abstract: The rapid growth of the IT industry has created a serious problem of electronic waste with old laptops servers and devices often ending up in landfills and harming the environment even though many of them can still be recycled or refurbished to create value. To address this issue the proposed idea is to develop a digital platform that connects people and businesses with certified recyclers and refurbishers to ensure that IT hardware is collected processed and reused in a responsible and efficient way.. This approach reduces landfill waste saves resources and lowers carbon emissions directly supporting the circular economy and aligning with global sustainability goals such as responsible consumption climate action and clean energy use. At the same time the platform offers strong business potential through subscription services partnerships with IT companies and the resale of refurbished products creating a model that is both profitable and socially responsible.

Keywords: Sustainable IT E-waste management Circular economy Climate action

DRONE PROGRAMMING 2025: INNOVATIONS AND BEST PRACTICES

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Abstract: The rapid growth of drone technology is creating transformative opportunities in sectors such as defence agriculture logistics disaster management and surveillance. The effectiveness of these unmanned aerial vehicles (UAVs) depends not only on hardware design but also on the innovations in their programming frameworks. This paper titled Drone Programming 2025: Innovations and Best Practices explores emerging paradigms and programming strategies that enhance drone performance autonomy and adaptability to real-world environments. The study highlights modular programming methods that improve scalability and flexibility enabling drones to respond to evolving mission requirements. Key innovations include the use of artificial intelligence for autonomous navigation and decision-making machine learning for object detection and swarm intelligence for coordinated multi-drone operations. Real-time data processing and edge computing approaches are examined to ensure low-latency responses and improved situational awareness.

Keywords: Drones UAV Artificial Intelligence Swarm Intelligence Programming Best Practices.

FAKE PROFILE AND DEEPPFAKE DETECTION SYSTEM

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Abstract— This paper proposes a Fake Profile and Deepfake Detection System that leverages machine learning (ML) and artificial intelligence (AI) to identify and mitigate these threats. The fake profile detection module analyzes behavioral patterns linguistic features profile metadata and social network interactions to differentiate between genuine and fraudulent accounts. Meanwhile the deepfake detection module employs convolutional neural networks (CNNs) and advanced forensic feature analysis to detect anomalies such as inconsistent facial expressions unnatural blinking pixel-level artifacts and audio-visual mismatches.

KEYWORDS : Fake profile detection Deepfake detection Machine learning Cybersecurity Social media forensics AI ethics

PREDICTIVE MODELING OF DIABETES DIAGNOSIS THROUGH DATA SCIENCE METHODS

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Abstract:-Diabetes is a long-term condition that has serious health implications worldwide and thus early diagnosis and good management are crucial. This work utilizes data science methods to create a predictive model for diabetes diagnosis based on patient health records. Machine learning models like Logistic Regression Decision Trees Random Forest and Support Vector Machines are used on a structured data set to determine patterns and significant risk factors with diabetes. Feature selection methods improve model performance by singling out the most significant clinical indicators.

Keywords:-*Diabetes prediction data science machine learning healthcare analytics classification models early diagnosis predictive modelling*

AI FOR SUSTAINABLE DEVELOPMENT AND SMART SOCIETIES

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Abstract: Artificial intelligence (AI) is recognized as a major driver towards economic and social sustainability and the creation of smart societies. And advanced AI algorithms (e.g. machine learning + Big Data analytics) have the potential to equip our societies with an effective use of resources lower environmental footprints and therefore a higher economic productivity. It is also improving energy management solutions to allow for the integration of renewable power generation smart grids and demand forecasting to minimize waste and curb carbon emissions .Artificial technologies such as intelligent transport systems reduce the consumption of oil products in smart cities. AI makes life convenient and secure for everyone with a bonus protecting the Earth. Lastly we call on governments educators and communities to address AI with a dose of caution and prudence. Some case studies and computer simulations can offer how AI evolves in real time.

DATA-DRIVEN SOLUTIONS FOR INDUSTRY 5.0.

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Abstract: Industry 5.0 marks a transformative phase in industrial evolution emphasizing collaboration between humans and intelligent machines to achieve sustainable efficient and personalized production. Data-driven solutions serve as the backbone of this revolution utilizing technologies such as Artificial Intelligence (AI) Big Data Internet of Things (IoT) and cloud computing to optimize industrial operations. These solutions enable predictive maintenance smart automation real-time monitoring and data-informed decision-making. By integrating advanced analytics with human creativity Industry 5.0 promotes innovation resilience and adaptability in manufacturing and service sectors. Furthermore data-driven frameworks help achieve environmental sustainability by reducing waste and energy consumption. This paper highlights the role of data-centric technologies in bridging human intelligence with digital transformation thereby driving the transition toward smarter sustainable and human-oriented industrial ecosystems.

Keywords : Industry 5.0 Data-driven solutions Artificial Intelligence Big Data Internet of Things Smart Manufacturing Human-machine collaboration Sustainability.

FUSION-BASED APPROACH FOR IDENTIFYING PEPPER LEAF DISEASES USING XGBOOST CLASSIFIER

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Abstract: Pepper plants are vulnerable to a variety of leaf diseases that threaten both crop quality and productivity. To enable early and accurate diagnosis this study presents a fusion-based detection model that combines advanced preprocessing feature extraction and machine learning techniques. Input leaf images are first enhanced using a bilateral filter to reduce noise while preserving edges and Contrast Limited Adaptive Histogram Equalization (CLAHE) to improve contrast. Disease-affected regions are then segmented using the watershed algorithm to isolate critical areas of analysis. From the segmented regions texture information is extracted through Gray Level Co-occurrence Matrix (GLCM) features which are fused with additional shape and color descriptors to form a robust feature set.

Keywords: GLCM CLAHE watershed algorithm bilateral filter XGBoost etc.

GENERATIVE AI AND ITS ROLE IN FUTURE COMPUTING

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Abstract :Generative AI is beginning to challenge our conception of what computers can do for us. Rather than simply answering questions or crunching numbers as the system has already learned to do from writing text creating images and even composing music; I helped scientists conjure new ideas. This shift again adds a step to computers making them even more human-like – not just tools but collaborators. Generative AI will support human-to-human learning as it learns one-on-one from students or patients and by working with professionals in their everyday work across all sectors from health to business; it will also reach creativity dimensions of our society like art and music through machines... learn autonomously from their outputs procedures and experiences such that human-input is not as much required anymore. This is a trend that will eventually make models flexible but also more lightweight cheaper to cost upfront and ultimately in general deploy into different settings.

SYNERGISTIC ADVANCES IN AI MACHINE LEARNING AND HIGH-PERFORMANCE COMPUTING: TOWARD SMARTER SCALABLE SYSTEMS

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Abstract: The rapid integration of Artificial Intelligence (AI) and Machine Learning (ML) techniques with evolving computing architectures is creating transformative opportunities across scientific industrial and societal domains. This paper discusses the emergence of new paradigms at the intersection of AI ML and computing power focusing on three pillars: Algorithm–Architecture Co-Design: As models grow in size and complexity there is a compelling need to co-design algorithms and hardware. We examine advances in neural architecture search sparsity-aware models and layer-wise adaptive optimizations in synergy with specialized accelerators (such as TPUs neuromorphic chips and optical hardware). Scalable Learning Systems: We present methods for distributed training federated learning model parallelism and efficient memory

Keywords: *Artificial Intelligence Machine Learning Deep Learning High-Performance Computing Distributed Systems Federated Learning Edge Computing Sustainable AI Smart Applications.*

YOLO-AQUA: INTELLIGENT DETECTION OF PLASTIC DEBRIS IN AQUATIC ENVIRONMENTS

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SRM Institute of Science and Technology*

Abstract: The use of plastic in water bodies has become a major global environmental problem threatening biodiversity and disrupting food chains in the oceans. Conventional methods of detecting plastic waste in water are often ineffective as they rely heavily on manual input especially in shifting and complex underwater environments. This project proposes an automated and intelligent system for detecting underwater plastic. It integrates the state-of-the-art object detection model YOLOv8 with Particle Swarm Optimization (PSO). YOLOv8 enables real-time detection with a lightweight anchor-free architecture making it effective in identifying irregularly shaped and partially concealed plastic debris in underwater video streams. However its performance declines when hyper parameters are manually tuned.

SMARTFORM: INTELLIGENT OCR SYSTEM FOR DIGITAL BANKING AUTOMATION

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Abstract: This paper describes SMARTFORM a web portal-based tool for automating bank form processing with Optical Character Recognition (OCR). The system includes a Flask backend that allows secure login/registration digital form submission and automatic handwriting/print text extraction using the Mistral AI OCR API. Data is extracted verified using a PIN based scheme before it is integrated to guarantee accuracy and security. We compare traditional OCR models like Tesseract and transformer-based models like Donut and LayoutLMv3 on structured and semi-structured documents. Performance is evaluated through Character Error Rate (CER) Word ErrorRate (WER) F1-score BLEU and qualitative visualization. Results show that while Tesseract's performance with pre-processing is good transformer models are able to perform better context and entity recognition but are prone to overfitting.

Keywords: *Optical Character Recognition Digital Banking SMARTFORM Transformer-based OCR Tesseract Hybrid Approach Automated Form Processing*

BIG DATA ANALYTICS FOR DECISION INTELLIGENCE IN HEALTHCARE

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Abstract : The exponential rise of healthcare data coupled with emerging technologies of artificial intelligence and machine learning has fostered unparalleled potential for the redesign of clinical decision-making processes. This paper provides an in-depth analysis of the use of big data analytics in healthcare decision intelligence systems while examining the combining of predictive analytics machine learning algorithms and real-time data processing paradigms for enhanced patient outcomes and operational effectiveness. We examine the state of decision intelligence platforms today and examine leading technological building blocks consisting of clinical decision support systems (CDSS) electronic health record (EHR) integration and standards of interoperability such as HL7 FHIR.

PREDICTING SEX FROM RETINAL FUNDUS PHOTOGRAPHS USING AUTOMATED DEEP LEARNING

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Abstract: Deep learning has demonstrated remarkable potential in transforming healthcare through automated image-based diagnosis. In this study we present a clinician-driven deep learning approach capable of predicting biological sex from retinal fundus photographs without the need for programming expertise. The model was trained on 84743 fundus images from the UK Bio bank dataset and externally validated on 252 retinal photographs from a tertiary ophthalmic referral center. The model achieved an area under the receiver operating characteristic curve (AUROC) of 0.93 with internal accuracy of 88.6% and external validation accuracy of 78.6%. These results indicate that retinal fundus images contain subtle previously unrecognized sex-specific features not discernible by clinicians. Our findings highlight the potential of automated deep learning systems to reveal novel biological insights

Keywords : Deep Learning Retinal Fundus Imaging Sex Prediction Automated Machine Learning Explainable AI Ophthalmology Biomedical Image Analysis Artificial Intelligence in Healthcare.

APPLYING CLUSTERING ALGORITHMS ON E-COMMERCE TRANSACTION DATA FOR IMPROVED INVENTORY MANAGEMENT DECISIONS

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Abstract : The expansion of e-commerce generates enormous amounts of transaction data (Big Data) which presents significant organizational opportunities. Meaningful exploitation of this data therefore is essential for effective Decision Intelligence use in order to optimize one or more operational aspects such as inventory management. This paper proposes a data-centric approach which segments products through clustering algorithms based on sales frequency contribution to revenue and seasonal demand profiles. We apply the K-means algorithm to sample e-commerce data to identify product groups such as high-velocity steady-demand and slow-moving. The findings provide evidence that segmentation provides useful insight enhances demand forecasting and allows inventory stocking decisions to be made using more informative and strategic methods that result in leading to reduced stock-outs and lower holding costs.

Keywords : *Big Data Clustering E-commerce Inventory Management Decision Intelligence K-means*

DATA-DRIVEN SOLUTIONS FOR INDUSTRY 5.0.

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Abstract: Industry 5.0 marks a transformative phase in industrial evolution emphasizing collaboration between humans and intelligent machines to achieve sustainable efficient and personalized production. Data-driven solutions serve as the backbone of this revolution utilizing technologies such as Artificial Intelligence (AI) Big Data Internet of Things (IoT) and cloud computing to optimize industrial operations. These solutions enable predictive maintenance smart automation real-time monitoring and data-informed decision-making. By integrating advanced analytics with human creativity Industry 5.0 promotes innovation resilience and adaptability in manufacturing and service sectors. Furthermore data-driven frameworks help achieve environmental sustainability by reducing waste and energy consumption. This paper highlights the role of data-centric technologies in bridging human intelligence with digital transformation thereby driving the transition toward smarter sustainable and human-oriented industrial ecosystems.

Keywords : *Industry 5.0 Data-driven solutions Artificial Intelligence Big Data Internet of Things Smart Manufacturing Human-machine collaboration Sustainability.*

FUSION-BASED APPROACH FOR IDENTIFYING PEPPER LEAF DISEASES USING XGBOOST CLASSIFIER

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Abstract: Pepper plants are vulnerable to a variety of leaf diseases that threaten both crop quality and productivity. To enable early and accurate diagnosis this study presents a fusion-based detection model that combines advanced preprocessing feature extraction and machine learning techniques. Input leaf images are first enhanced using a bilateral filter to reduce noise while preserving edges and Contrast Limited Adaptive Histogram Equalization (CLAHE) to improve contrast. Disease-affected regions are then segmented using the watershed algorithm to isolate critical areas of analysis. From the segmented regions texture information is extracted through Gray Level Co-occurrence Matrix (GLCM) features

Keywords: GLCM CLAHE watershed algorithm bilateral filter XGBoost etc.

A SECURE AND AUTOMATED STUDENT BIOMETRIC ATTENDANCE MONITORING AND ANALYTICS SYSTEM

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ABSTRACT: A secure and automated attendance monitoring and analytics system designed to eliminate proxy attendance and enhance institutional integrity. The proposed framework integrates short-lived session tokens on-device multi-factor biometric verification and cryptographic device attestation to ensure authenticity and privacy. At the beginning of each class session the instructor’s dashboard issues a server-signed rotating Quick Response (QR) code that changes every 5–10 seconds. Students scan the QR code using a cross-platform mobile application built with React Native initiating a two-phase verification process. In Phase I the mobile application performs on-device face detection and the device cryptographically signs a session nonce using secure keys stored in the platform’s hardware keystore.

Keywords: Automated attendance; face recognition; liveness detection; biometric attestation; rotating QR tokens; NFC proximity; on-device inference; vector search (FAISS).

BIG DATA ANALYTICS FOR DECISION INTELLIGENCE IN HEALTHCARE

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The exponential rise of healthcare data coupled with emerging technologies of artificial intelligence and machine learning has fostered unparalleled potential for the redesign of clinical decision-making processes. This paper provides an in-depth analysis of the use of big data analytics in healthcare decision intelligence systems while examining the combining of predictive analytics machine learning algorithms and real-time data processing paradigms for enhanced patient outcomes and operational effectiveness. We examine the state of decision intelligence platforms today and examine leading technological building blocks consisting of clinical decision support systems (CDSS) electronic health record (EHR) integration and standards of interoperability such as HL7 FHIR.

A COMPREHENSIVE REVIEW ON DATA SECURITY CHALLENGES IN MEDICAL DATA WIRELESS TRANSMISSION

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Abstract-Wireless transmission is the backbone of modern communication systems powering mobile broadband IoT vehicular networks and mission-critical services. Its open-air medium and diverse protocol stack however expose data to a wide array of security challenges. This comprehensive review synthesizes recent literature to map the threat landscape—covering passive attacks (eavesdropping traffic analysis) active attacks (jamming replay man-in-the-middle routing manipulation) and systemic weaknesses introduced by mobility resource-constrained devices heterogeneity of radio technologies and increasingly software-defined network elements. We evaluate conventional and emerging countermeasures across layers: cryptographic primitives and key management tailored for low-power devices; authentication

Keywords: wireless security IoT physical-layer security lightweight cryptography intrusion detection jamming key management

ANALYSIS OF COIMBATORE BIKE SHARING SYSTEM

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Abstract: Urban mobility challenges such as increasing traffic congestion rising fuel consumption and deteriorating air quality have become major issues in rapidly developing cities. Coimbatore as one of Tamil Nadu's fastestgrowing urban centers faces similar transportation constraints that demand innovative and sustainable mobility solutions. This study explores the implementation of an IoT-driven Bike Sharing System in Coimbatore modeled after the successful CitiBike program in New York City. The research utilizes open-source datasets and performs comprehensive analysis using Excel for data preprocessing SQL for database querying and Tableau for visualization. These tools collectively help in identifying critical factors such as peak usage hours high-demand stations user demographics and seasonal trends.

Keywords: *IoT Smart City Data Analysis Bike Sharing Sustainable Transport*

DATA-DRIVEN PREDICTION OF ACADEMIC SUCCESS USING MACHINE LEARNING TECHNIQUES

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Abstract: In the era of data-driven decision-making predicting student performance has become an essential tool for improving the quality of education and academic planning. Machine Learning (ML) algorithms provide powerful techniques to analyze large volumes of educational data and uncover hidden patterns that influence student success. This study focuses on developing predictive models to estimate student performance based on various factors such as attendance internal assessment scores socio-economic background study habits and participation in academic activities.. The results demonstrate that integrating Machine Learning into academic analytics can significantly support evidence-based decision-making and personalized learning. Ultimately student performance prediction systems serve as valuable tools for educational institutions to improve academic success rates and ensure holistic student development.

Keywords : *Student Performance Machine Learning Predictive Modeling Educational Data Mining Academic Analytics*

THE ETHICAL AND ECONOMIC IMPACT OF ARTIFICIAL INTELLIGENCE ON SOCIETY

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Abstract:-Artificial Intelligence (AI) is rapidly changing the world bringing huge economic opportunities but also serious ethical problems. This paper looks at how AI-driven economic growth and its ethical challenges are connected. Economically AI is great for making businesses more productive automating work and creating new kinds of jobs which should lead to more wealth. However this same shift could also lead to higher job loss and a bigger gap between the rich and the poor as machines replace human workers. We need to quickly think about solutions like new training programs or perhaps a basic income for everyone. Ethically the biggest worry is algorithmic bias. This means AI systems can make unfair decisions (in hiring or lending for example) if they are trained on flawed data that already reflects human prejudices.

A GENERATIVE AI APPROACH FOR PERSONALIZED LEARNING AND SMART EDUCATION

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Abstract—The integration of Artificial Intelligence (AI) into education has significantly transformed conventional learning environments. This paper introduces a Generative AI-driven framework for personalized learning and smart education aimed at enhancing student engagement adaptability and academic performance. The proposed system utilizes large language models (LLMs) and generative algorithms to dynamically generate customized learning content interactive assessments and real-time feedback tailored to each learner’s pace style and comprehension level. By analyzing behavioral data learning patterns and assessment outcomes the system continuously refines instructional materials and recommends individualized learning paths.

Keywords — *Generative AI Personalized Learning Smart Education Large Language Models Adaptive Learning Systems Educational Technology*

CUSTOMER CHURN PREDICTION FOR A SUBSCRIPTION SERVICE

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Abstract— In today’s competitive subscription-based market retaining existing customers is more cost-effective than acquiring new ones. This paper presents a Customer Churn Prediction System designed to identify potential customer attrition using machine learning techniques. The proposed model analyzes various customer behavior metrics such as usage patterns service duration payment history and engagement frequency to predict churn probability. A Random Forest classification algorithm is implemented to achieve high accuracy and interpretability supported by data preprocessing and feature engineering for optimal model performance. The system also integrates a Power BI dashboard for real-time visualization of churn trends customer segments and predictive insights enabling data-driven decision-making.

Keywords— Customer Churn Machine Learning Random Forest Predictive Analytics Power BI.

PRECISION FARMING THROUGH ARTIFICIAL INTELLIGENCE

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Abstract:Through the use of sensor technology machine learning algorithms and advanced data analytics precision farming using artificial intelligence (AI) maximizes agricultural practices increases crop yields and minimizes resource waste. Real-time insights about crop growth pest infestations weather and soil health can be obtained by farmers by combining AI with Internet of Things (IoT) devices satellite imaging and drone-based monitoring. Improved sustainability and profitability result from data-driven decision-making for disease prevention fertilizer application and irrigation timing made possible by these insights. Predictive models using AI support effective supply chain management yield forecasting and early anomaly detection.

Keywords: Artificial Intelligence Precision Farming Machine Learning IoT Sensors Drone Monitoring Data Analytics Smart Irrigation Crop Yield Prediction Sustainable Agriculture Climate-Resilient Farming.

AUTO-RECOVERY OF DAMAGED PHOTOS USING CONVOLUTIONAL NEURAL NETWORKS

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Abstract: The preservation and restoration of damaged photographs is a critical task in digital archiving cultural heritage conservation and personal memory safeguarding. This paper presents a novel approach for automatic photo recovery using Convolutional Neural Networks (CNNs) leveraging deep learning to reconstruct missing or corrupted regions with high fidelity. Our method employs a multi-stage CNN architecture that integrates image inpainting noise reduction and texture synthesis to restore visual coherence in degraded images. We trained the model on a diverse dataset of artificially damaged and real-world photographs achieving superior performance compared to traditional restoration techniques. Quantitative evaluations using PSNR and SSIM metrics demonstrate the effectiveness of our approach

Keywords: *Convolutional Neural Network Image Restoration Photo Recovery Deep Learning Inpainting Noise Reduction Digital Archiving*

DECENTRALIZED TOT ECOSYSTEMS: EMPOWERING TRUST AND TRANSPARENCY IN THE DIGITAL ERA

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Abstract: -In the rapidly evolving digital landscape decentralization has emerged as a transformative paradigm for creating transparent secure and user-centric ecosystems. The concept of Decentralized ToT (Token of Trust / Training of Trainers) Ecosystems represents an innovative approach to building distributed networks that foster collaboration authenticity and accountability without relying on centralized authorities. This conference explores the convergence of blockchain technology smart contracts and token-based governance models to establish systems that ensure data integrity enhance trust and promote equitable participation across digital platforms. By decentralizing control and introducing verifiable tamper-proof frameworks ToT ecosystems can revolutionize sectors such as education supply chain management digital identity and financial systems.

keywords: *Decentralized Ecosystems Blockchain Technology Token of Trust (ToT)Smart ContractsDigital Trust*

AI-DRIVEN PHYTOGUARD SYSTEM: A DEEP LEARNING-BASED APPROACH FOR EARLY DETECTION AND CONTROL OF CROP DISEASES IN SMART AGRICULTURE

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Abstract—Crop diseases greatly impact food production and farmer livelihoods. This study aims to develop PhytoGuard an AI-driven system for early detection and management of crop diseases. Using deeplearning and image recognition the project seeks to provide accurate diagnosis timely treatment suggestions and promote smart sustainable farming through real-time digital tools. The study employs adeep learning approach using Convolutional Neural Networks (CNNs) trained on the Plant Village dataset for crop disease classification. Images are preprocessed augmented and analyzed to improve model accuracy. The trained model is integrated into a cloud-based web and mobile platform enabling real-time disease detection and management for farmers. The proposed PhytoGuard system achieved a classification accuracy of 96.3% on the Plant Village dataset using the CNN model..

Keywords—Crop diseases AI Deep learning CNN Image recognition Smart farming Real-time detection

SOFTWARE-DEFINED FAULT ISOLATION IN LOW TENSION POWER SYSTEMS: ADVANCED DETECTION AND LINE DE-ENERGIZATION

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Abstract — Modern low-voltage (LT) power systems face challenges in rapid and selective fault isolation due to increasing complexity and distributed generation. This study introduces a novel Software-DefinedFault Isolation (SDFI) system to enhance the reliability and safety of LT power networks. The system employs real-time data analytics and advanced signal processing to precisely detect fault events and uses software-defined controls for selective and swift line de-energization minimizing disruption to healthy sections. The methodology involves deploying intelligent electronic devices (IEDs) for high-fidelity current and voltage measurement. A machine learning-based algorithm is developed and trained on simulated and real-world fault signatures (e.g. short-circuits ground faults) to achieve fast and accurate fault identification and location.

Keywords — Power Grid Fault Detection Software Control Machine Learning Protection.

CYBERSECURITY IN IOT AND CRITICAL INFRASTRUCTURE

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Abstract: The rapid proliferation of Internet of Things (IoT) devices and their integration into critical infrastructure sectors—such as energy healthcare transportation and water systems—has introduced significant cybersecurity challenges. These systems are increasingly becoming targets for sophisticated cyberattacks potentially leading to widespread disruption data breaches and physical damage. This paper explores the unique security vulnerabilities inherent in IoT-enabled critical infrastructure such as constrained device resources lack of standardization and legacy system integration. It also analyzes emerging threats attack vectors and real-world incidents that illustrate the risks. Furthermore the paper discusses current defense mechanisms including network segmentation intrusion detection systems (IDS) encryption protocols and AI-driven anomaly detection. Emphasis is placed on the need for a holistic and proactive cybersecurity strategy that encompasses risk assessment policy development and regulatory compliance.

Keywords: *Cybersecurity IOT Critical Infrastructure*

APPLYING CLUSTERING ALGORITHMS ON E-COMMERCE TRANSACTION DATA FOR IMPROVED INVENTORY MANAGEMENT DECISIONS

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Abstract—The expansion of e-commerce generates enormous amounts of transaction data (Big Data) which presents significant organizational opportunities. Meaningful exploitation of this data therefore is essential for effective Decision Intelligence use in order to optimize one or more operational aspects such as inventory management. This paper proposes a data-centric approach which segments products through clustering algorithms based on sales frequency contribution to revenue and seasonal demand profiles. We apply the K-means algorithm to sample e-commerce data to identify product groups such as high-velocity steady-demand and slow-moving. The findings provide evidence that segmentation provides useful insight enhances demand forecasting and allows inventory stocking decisions to be made using more informative and strategic methods that result in leading to reduced stock-outs and lower holding costs.

Keywords— *Big Data Clustering E-commerce Inventory Management Decision Intelligence K-means*

A MACHINE LEARNING BASED WEB APPLICATION FOR SMS SPAM DETECTION

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Abstract- The project "SMS Spam Detection using Machine Learning" addresses the challenge of identifying spam messages in SMS communication by leveraging advanced machine learning techniques. Implemented using Python for backend processing and integrated with a user-friendly frontend crafted in HTML CSS and JavaScript this web application utilizes the Flask framework to ensure a seamless and responsive user experience. The core of this project involves the development and deployment of two distinct machine learning models to classify SMS messages as either spam or ham (non-spam). The first model employs a Support Vector Classifier (SVC) which achieved an impressive training accuracy of 99.2% and a test accuracy of 98.30%. This high level of precision underscores the model's robustness and reliability in distinguishing between spam and legitimate messages.

Keywords— *Big Data Clustering E-commerce Inventory Management Decision Intelligence K-means*

DATA-DRIVEN SOLUTIONS FOR INDUSTRY 5.0.

Mr.Dasari Mahesh UG Student Department of CSE Sri Ve nkateswara College of Engineering Tirupati Andhra Pradesh.

Abstract: Industry 5.0 marks a transformative phase in industrial evolution emphasizing collaboration between humans and intelligent machines to achieve sustainable efficient and personalized production. Data-driven solutions serve as the backbone of this revolution utilizing technologies such as Artificial Intelligence (AI) Big Data Internet of Things (IoT) and cloud computing to optimize industrial preparations. These solutions enable predictive maintenance smart automation real-time monitoring and data-informed decision-making. By integrating advanced analytics with human creativity Industry 5.0 promotes novation resilience and adaptability in manufacturing and service sectors. Furthermore data-driven frameworks help achieve environmental sustainability by reducing waste and energy consumption. This paper highlights the role of data-centric technologies in bridging human intelligence with digital transformation thereby driving the transition toward smarter sustainable and human-oriented industrial ecosystems.

Keywords : *Industry 5.0 Data-driven solutions Artificial Intelligence Big Data Internet of Things Smart Manufacturing Human-machine collaboration Sustainability.*

AI-POWERED SMART WASTE SEGREGATION AND FILL-LEVEL PREDICTION SYSTEM

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Abstract: Heavy urbanization and high population growth have created considerable difficulty in efficient waste management leading to pollution of the environment and wasteful disposal. Manual waste segregation is a time-consuming hygienic and inaccurate process. In this paper an AI-Powered Smart Waste Segregation and Fill-Level Prediction System is suggested integrating Artificial Intelligence (AI) and Internet of Things (IoT) technology to make waste classification automated and collection efficiency maximized. The system utilizes a camera module combined with a convolutional neural network (CNN) to sort waste into types like biodegradable non-biodegradable and recyclable materials. An ultrasonic sensor is used to continuously measure the fill level of the bin whereas live data is sent to a cloud platform through Wi-Fi for visualization and analysis.

Keywords: Urban waste problem = inefficient manual segregation and delayed collection Solution = AI + IoT + ML enable smart waste sorting and monitoring

DYNAMIC CYBER RISK MODELING FOR THE NEXT-GENERATION ENTERPRISE

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Abstract; In today's hyper-connected digital environment traditional static risk assessment models are no longer sufficient to address the evolving landscape of cyber threats. Dynamic Cyber Risk Modeling (DCRM) introduces a real-time adaptive approach to identify assess and mitigate risks across next-generation enterprises. This paper explores how DCRM integrates artificial intelligence threat intelligence and behavioral analytics to continuously update an organization's risk posture. By leveraging data-driven insights and automation enterprises can proactively respond to emerging vulnerabilities and reduce the impact of cyber incidents. The study also highlights the role of predictive modeling in enhancing resilience optimizing resource allocation and enabling smarter decision-making. Ultimately dynamic risk modeling ensures that cyber defense strategies evolve as rapidly as the threats themselves empowering enterprises to maintain security stability and trust in the digital era.

SMART AGRICULTURE ASSISTANT FOR MULTILINGUAL FARMER SUPPORT E-COMMERCE INTEGRATION AND GOVERNMENT SUBSIDY AWARENESS

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Abstract - Agriculture serves as the backbone of the economy playing a critical role in food security employment generation and rural development. However farmers frequently encounter challenges such as lack of timely expert advice difficulty in purchasing genuine agricultural inputs and limited awareness of government schemes and subsidies. These limitations hinder productivity crop quality and access to support systems. An E-Commerce module enables farmers to securely purchase authentic seeds fertilizers pesticides and plants with digital payment and order tracking. Additionally a Government Subsidy Awareness module provides up-to-date information on schemes and subsidies based on crop type and region. The proposed platform enhances decision-making promotes the use of authentic agricultural products and increases awareness of government support systems.

Keywords — smart agriculture ai chatbot nlp e-commerce multilingual platform government schemes sustainable farming.

FUSION-BASED APPROACH FOR IDENTIFYING PEPPER LEAF DISEASES USING XGBOOST CLASSIFIER

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Abstract-Pepper plants are vulnerable to a variety of leaf diseases that threaten both crop quality and productivity. To enable early and accurate diagnosis this study presents a fusion-based detection model that combines advanced preprocessing feature extraction and machine learning techniques. Input leaf images are first enhanced using a bilateral filter to reduce noise while preserving edges and Contrast Limited Adaptive Histogram Equalization (CLAHE) to improve contrast. Disease-affected regions are then segmented using the watershed algorithm to isolate critical areas of analysis. From the segmented regions texture information is extracted through Gray Level Co-occurrence Matrix (GLCM) features which are fused with additional shape and color descriptors to form a robust feature set.

Keywords: GLCM CLAHE watershed algorithm bilateral filter XGBoost etc.

SYNERGISTIC INTEGRATION OF QR-BASED TRACKING AND AUTOMATED BILLING IN A UNIFIED WEB PLATFORM FOR BAKERY MANAGEMENT

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ABSTRACT: The inefficiency of manual methods in the bakery industry presents a significant challenge to inventory control and operational management. This paper introduces a secure web-based Billing System designed to modernize and optimize these processes through a unified digital platform. The system's architecture is centered on unique QR codes assigned to each product enabling detailed tracking of batches expiry dates and stock levels. Key features include automated expiry alerts to reduce waste an integrated QR scanner for rapid point-of-sale transactions and a customer portal for online ordering. Furthermore the platform consolidates administrative tasks by incorporating an employee attendance module and providing intuitive dashboards for monitoring sales analytics and inventory. Built on a robust stack of React.js Node.js Express.js and MySQL the system ensures data integrity and high performance.

Keywords: Billing System QR code inventory management bakery management digital automation.

GENERATIVE AI AND ITS ROLE IN FUTURE COMPUTING

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Abstract—Generative Artificial Intelligence (AI) is revolutionizing computer creativity enabling machines to produce novel content like text images code audio and simulations by learning from underlying data patterns. This paper provides a human-centric perspective on generative AI techniques explores real-world applications and examines the impact on future computing platforms and interactions. We also discuss ethical considerations and offer practical guidelines for responsible implementation.

Keywords— Generative AI GANs Future Computing Sustainable AI Green Computing AI Governance Foundation Models

HUMAN-AI COLLABORATION GRAD ALUMNI CHAT

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Abstract: The Alumni and Student Interaction Application is a digital platform designed to bridge the gap between current students and alumni fostering a collaborative environment for mentorship career guidance and community engagement. This application serves as a centralized hub where students can connect with alumni to gain insights into industry trends explore internship and job opportunities and receive academic support. Alumni in turn can contribute by sharing their professional experiences offering guidance and participating in live sessions to engage with students. The platform features secure login systems user profiles messaging capabilities and event management tools to facilitate seamless communication and interaction. By integrating these functionalities the application aims to enhance the educational experience promote professional development and strengthen the bond between alumni and their alma mater

Keywords: *Billing System QR code inventory management bakery management digital automation.*

BLOCKCHAIN-ENABLED VOTING SYSTEM WITH OTP VERIFICATION AND OFF-CHAIN PRIVACY PROTECTION

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Abstract: This paper proposes a secure and transparent blockchain-based voting framework designed to uphold voter privacy prevent manipulation and ensure one-vote-per-user compliance in decentralized electronic elections. The system incorporates a lightweight authentication mechanism using one-time password (OTP) verification combined with off-chain hashed identity storage to safeguard personal information. Unlike conventional blockchain voting systems that depend solely on smart contract logic the proposed model enhances end-to-end security by validating voter eligibility prior to on-chain participation. To mitigate performance overheads and storage constraints non-essential identity information is excluded from the blockchain with hashed authentication tokens serving as cryptographic evidence of voter validity.

Keywords: *OTP Authentication Voter Anonymity Off-Chain Data Protection Smart Contract Security Privacy-Preserving E-Voting Decentralized Ballot System*

INTEGRATION OF EEG-BASED STRESS DETECTION AND SOLAR ENERGY IN A SMART INHALER SYSTEM FOR ASTHMA MONITORING

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Abstract—This paper presents an inventive solution for asthma management combining the latest advancements in Artificial Intelligence of Things (AIoT) neuro-sensing technologies and renewable energy systems. At the core of the system is the NeuroSolar Inhaler an advanced device that merges environmental monitoring physiological sensing and real-time brainwave analysis to identify asthma triggers linked to emotional stress. The inhaler integrates a sophisticated array of sensors capable of detecting key environmental factors such as airflow temperature humidity and barometric pressure. Additionally it features a miniaturized EEG unit to capture brainwave activity related to stress—an often underrecognized contributor to asthma flare-ups. The inhaler operates sustainably by using bendable solar film to draw energy from natural light allowing it to function without traditional power sources and supporting a greener energy approach .

Keywords: *airflow temperature humidityData Protection*

GENERATIVE AI AND ITS ROLE IN FUTURE COMPUTING

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Abstract—Generative AI is beginning to challenge our conception of what computers can do for us. Rather than simply answering questions or crunching numbers as the system has already learned to do from writing text creating images and even composing music; I helped scientists conjure new ideas. This shift again adds a step to computers making them even more human-like – not just tools but collaborators. Generative AI will support human-to-human learning as it learns one-on-one from students or patients and by working with professionals in their everyday work across all sectors from health to business; it will also reach creativity dimensions of our society like art and music through machines. Generative AI is the dawn of a new computing era where we no longer author only what we understand and see but also enable machines to author alongside us.

FORECASTING SOFTWARE VULNERABILITY BASED ON THE TIME SERIES USING DEEP LEARNING TECHNIQUES

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Abstract:-The rapid growth of software systems has led to an exponential increase in potential vulnerabilities posing significant threats to cybersecurity. Timely identification and forecasting of these vulnerabilities are crucial for proactive defense and risk mitigation. In this study a deep learning-based framework is proposed to predict software vulnerabilities using time series data derived from historical vulnerability reports and code change metrics. The model employs recurrent neural networks (RNN) and long short-term memory (LSTM) architectures to capture temporal dependencies and long-range correlations in vulnerability trends. Experimental analysis demonstrates that the proposed model achieves high predictive accuracy and robustness compared to conventional machine learning approaches. The time-aware forecasting framework enables security analysts to anticipate vulnerability occurrences prioritize patch deployment and allocate resources efficiently.

Keywords: *Software Vulnerability Time Series Forecasting Deep Learning Cybersecurity Predictive Analysis*

KEEPING UP WITH CYBER THREATS THROUGH CYBER THREAT INTELLIGENCE

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Abstract:-With the increase in both sophistication and frequency of cyber threats organizations need to change from a reactive to a proactive posture in cybersecurity operations. Cyber Threat Intelligence (CTI) is an actionable tactic that enables the organization to anticipate detect and mitigate potential cyber attacks before they happen. This session will explain how CTI fits within modern cybersecurity operations and its benefits to organizational cybersecurity by offering actionable resolution to new and emerging threats. When we collect and analyze cyber threat data in addition to sharing it with other organizations we build an organizational understanding of the tactics techniques and procedures in which cyber adversaries operate. We will discuss the express approaches of CTI as well from tactical intelligence related to threats that require immediate resolution to strategic intelligence that can inform future security planning.

DEVELOPMENT OF A DIGITAL FARM MANAGEMENT PORTAL FOR MONITORING MAXIMUM RESIDUE LIMITS (MRL) AND ANTIMICROBIAL USAGE (AMU) IN LIVESTOCK

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Abstract:-Antimicrobials are a vital tool in keeping animals healthy on farms but their overuse in livestock farming is starting to cause big problems. Not only does this lead to antimicrobial resistance (AMR) but it also raises concerns about food safety as harmful antimicrobial residues can end up in the food supply. This report proposes a solution: a Blockchain-based Digital Farm Management Portal designed to help monitor and regulate antimicrobial use (AMU) ensure compliance with Maximum Residue Limits (MRL) and provide full traceability and transparency across the food supply chain. The platform uses modern technologies like blockchain (Hyperledger Fabric) OCR-based digital prescription management real-time dashboards QR-code traceability and automated compliance checks. By bringing together farmers veterinarians regulators and consumers on a single platform it aims to improve food safety strengthen enforcement of regulations and restore trust in the livestock industry.

HEALTH LANGUAGE TRANSLATOR

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Abstract— The Universal Language Translator is a web-based application designed to seamlessly convert any default language into a user-specified destination language. It integrates multiple translation modes including Text-to-Speech Speech-to-Text Image-to-Text PDF Translation and Sign Language to Text offering a versatile platform capable of handling diverse input formats. The front end is developed using HTML CSS and JavaScript providing a responsive and intuitive user interface that begins with a secure login system. Users can select the desired translation mode after which the system automatically detects the input language and generates the output in the selected target language. The backend is implemented using Python with Flask which manages communication between the frontend and various APIs for translation speech recognition and optical character recognition (OCR).

Keywords : Language Translator Text-to-Speech Speech-to-Text Image-to-Text PDF Translation Sign Language to Text Language Detection OpticalCharacter Recognition (OCR)

VISION-BASED DRIVER YAWNING DETECTION USING LIGHTWEIGHT ATTENTION MECHANISM

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Abstract:—Driver drowsiness is a major cause of road accidents highlighting the need for real-time monitoring systems to enhance road safety. The problem of drowsiness among drivers stands out as a primary reason behind road accidents which justifies the use of real-time monitoring to improve road safety. A vision-based driver yawning detection system is employed in this study to take advantage of a lightweight system of attention in enhancing detection accuracy and computational efficiency. The developed solution uses a deep learning-based transfer learning method that uses the Inception-ResNet-v2 model to differentiate between two categories of driver states: Yawning and Normal. Using MATLAB the dataset of 2600 images was curated and pre-processed so that the classes were balanced so as to give optimal performance by the model. The model is trained using the Stochastic Gradient Descent with Momentum (SGDM) and with a high accuracy of 95.2 at the classification.

Keywords—yawning drowsiness CNN YAWDD attention mechanism MATLAB.

MALWARE DETECTION AND REMOVAL USING MACHINE LEARNING

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Abstract The rapid growth of malware in complexity and volume poses a serious challenge for cybersecurity. Traditional signature-based detection systems struggle more and more against zero-day attacks polymorphic malware and advanced obfuscation methods. This paper presents an integrated deep learning framework that uses Convolutional Neural Networks (CNNs) for malware detection and denoising autoencoders for cleaning files. Our approach converts binary files into grayscale images allowing for spatial feature extraction through CNNs. We also use a denoising autoencoder to turn infected files back into safe versions.

Keywords— Malware Detection Deep Learning Convolutional Neural Networks (CNN) Autoencoders Cybersecurity Static Analysis File Sanitization Obfuscated Malware

ADVANCED MALWARE ANALYSIS SANDBOX FOR BEHAVIORAL DETECTION OF MALICIOUS SOFTWARE

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Abstract: The growing sophistication of modern malware presents a major challenge in ensuring digital security and protecting critical systems. This project proposes the design and implementation of an Advanced Malware Analysis Sandbox a controlled and isolated environment that enables safe execution and behavioral observation of malicious software. Wireshark and Fakenet-NG along with customized Python automation this system provides detailed insights into malware behavior including file modifications registry changes and external communications. The proposed framework enhances malware research and contributes to proactive cyber defense by enabling analysts to detect understand and mitigate evolving threats effectively.

Keywords: Malware Analysis Sandbox Cybersecurity Threat Detection Virtualization

ENHANCING STUDENT CAREER PLANNING THROUGH INTELLIGENT COMPUTER-ASSISTED CAREER GUIDANCE TOOLS

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Abstract: Computer-Assisted Career Guidance (CACG) systems are advancing educational counselling by enhancing accessibility personalisation and efficiency in supporting students' career planning. These AI-driven tools utilise technologies such as machine learning fuzzy logic and ontology-based reasoning to analyse diverse student data including academic performance skills personality traits and interests to offer customised career recommendations. Deployed through web and mobile platforms CACG tools present scalable interactive alternatives to traditional counselling supporting informed decision-making even where counsellor access is limited. Despite these benefits challenges like data privacy accuracy of personalisation and adoption barriers remain critical concerns. Continued research into emerging technologies— including AI cloud computing and IoT—is vital to improve the reliability ethical standards and efficacy of CACG tools

Keywords: Computer-Assisted Career Guidance (CACG) Artificial Intelligence (AI) Career Planning Career Counselling Career Guidance Education Systematic Literature Review(SLR).

SYNERGISTIC ADVANCES IN AI MACHINE LEARNING AND HIGH-PERFORMANCE COMPUTING: TOWARD SMARTER SCALABLE SYSTEMS

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Abstract— The rapid integration of Artificial Intelligence (AI) and Machine Learning (ML) techniques with evolving computing architectures is creating transformative opportunities across scientific industrial and societal domains. This paper discusses the emergence of new paradigms at the intersection of AI ML and computing power focusing on three pillars: We examine advances in neural architecture search sparsity-aware models and layer-wise adaptive optimizations in synergy with specialized accelerators (such as TPUs neuromorphic chips and optical hardware). The role of compression quantization and low-bit representations in enabling scalability is emphasized. We highlight case studies from healthcare smart cities autonomous systems and climate modeling demonstrating how coupling AI/ML methods with high-throughput computing resources yields tangible gains.

SMART AVIATION DECISION SUPPORT SYSTEM: INTEGRATION OF FLIGHT DELAY PREDICTION WITH AUTOMATED NOTAM FOR AIRMEN SAFETY

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Abstract: Notification to Airmen are notices distributed by means of telecommunication containing information concerning the establishment condition or change in any aeronautical facility service procedure or hazard the timely knowledge of which is essential to personnel concerned with flight operations. NOTAMs (NOTification to AirMen) are time-critical safety-critical announcements of temporary changes to global flight conditions. It covers the aerospace flight environment such as the condition and availability of many airport facilities (including runways instrumentation & fuel) flight / navigational aids restrictions on airspace (weather political & commercial) and a great variety of air traffic regulations and flight related concerns. In the existing System NOTAM details are updated for manual and the details are provided in the form of text only. In this Paper consider weather as a one of the key factor for the aviation NOTAM. Establish the specific requirements including the sets of NOTAMs data sources to be used and the decision support system(s) using Logistic Regression.

ONLINE COMPLAINT REGISTRATION USING CLASSIFICATION ALGORITHM

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Abstract: For getting a problem solved at any place people may have to wait for three months but it can probably be solved sooner. Nowadays the scenario has changed. Many applications are available which allow users to register their complaints. But there are some problems related to its transparency. The purpose of this project is to provide the complaints for different products and getting reply from the products handling teams. Customers may have complaints about its products. They will be given details for each product. These details will get converted to complaints and get assigned to the persons handling that product. The complaints can be assigned to different persons and will get tracked to closure. The person handling the complaint will have the facility to communicate with the customer via web application. The Visual studio is used for the attractive and designing front end. Sql Server is used for the back end development to connect with the database.

Keywords: Visual Studio SQL Complaint Process Minimize

ECO-AGRI SYNERGY: ADVANCING SUSTAINABLE DEVELOPMENT THROUGH EFFECTIVE LAND MANAGEMENT

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Abstract: Sustainable agricultural transformation has become imperative in addressing global challenges such as climate change soil degradation and food insecurity. The integration of ecological principles into agricultural systems offers a balanced approach to enhancing productivity while conserving natural resources. This study explores strategies to harmonize ecology and agriculture for effective land management emphasizing the importance of biodiversity conservation soil health restoration and climate-resilient farming practices. By adopting eco-friendly technologies organic inputs and precision agriculture farmers can optimize yield without compromising environmental integrity. The paper highlights case studies and innovative models that demonstrate how sustainable land management fosters economic stability environmental protection and social well-being. Ultimately harmonizing ecological balance with agricultural productivity serves as a cornerstone for achieving the United Nations’ Sustainable Development Goals (SDGs) ensuring long-term food security and ecosystem resilience.

Keywords - Automated Farming Predictive Analytics classification machine learning models

REINFORCEMENT LEARNING-BASED ADAPTIVE DEFENSE MECHANISMS IN NETWORK SECURITY

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Abstract—This paper explores the integration of Reinforcement Learning (RL) techniques to enhance cybersecurity protocols. RL a type of machine learning where an agent learns to make decisions by receiving rewards or penalties offers a promising approach for developing adaptive and autonomous security systems. By modeling cybersecurity challenges as RL problems this approach enables protocols to learn from interactions with their environment continuously improving their ability to detect and respond to threats. The paper reviews current methodologies in applying RL to various aspects of cybersecurity including intrusion detection threat response and vulnerability management. It also discusses the potential benefits and challenges associated with this approach providing a comprehensive overview of how RL can contribute to advancing cybersecurity practices.

RISK FACTORS AND REHABILITATION APPROACHES FOR INTERNET GAMING DISORDER AND COGNITIVE DEFICITS

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Abstract— Internet Gaming Disorder (IGD) has emerged as a critical issue associated with behavioral addictions social anxieties aggression and cognitive impairments. This survey integrates findings from recent studies to explore the relationships between IGD social appearance anxiety smartphone addiction and aggression. Studies indicate that social appearance anxiety and smartphone addiction are strong predictors of IGD with smartphone addiction playing a partial mediating role in the relationship between aggression and IGD. Cognitive impairments such as memory deficits and impaired social cognition are also common in individuals with IGD alongside heightened loneliness and challenges in maintaining healthy interpersonal relationships. Innovative solutions including cognitive computing and edge-computing systems offer promising approaches to managing addiction.

Keywords—Internet Gaming Disorder Smartphone Addiction Cognitive Impairments Cognitive-Behavioral Therapy Aggression and Addiction Serious Games for Rehabilitation Social Appearance Anxiety Addiction and Emotional Regulation

SELF-HEALING DATABASES USING AI-POWERED DATA ANOMALY RENERATION

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Abstract:- In modern data-driven environments maintaining database integrity and consistency is a critical challenge due to data corruption transmission errors or unexpected system failures. Traditional recovery mechanisms rely heavily on static backups and transaction logs which often result in data loss or partial restoration. This paper proposes a novel self-healing database architecture that employs AI-powered anomaly detection and data regeneration techniques to autonomously identify reconstruct and validate corrupted or missing records.

Keywords—Internet Gaming Disorder Smartphone Addiction Cognitive Impairments Cognitive-Behavioral Therapy Aggression and Addiction

SMART LEARNING PATTERN ANALYSIS

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Abstract—EduLink AI is a transformative platform harnessing advanced artificial intelligence to revolutionize education mentorship and career development. By addressing gaps in personalized learning equitable access and social impact the platform offers an intelligent suite of features including automated study planning AI-powered note digitization and dynamic alumni networks. Innovatively EduLink AI integrates smart glasses technology capable of real-time speech-to-text transcription and translation into the user’s preferred language facilitated through Bluetooth headphones or speakers. This wearable device breaks communication barriers among learners from diverse linguistic backgrounds. Key features include ethical AI for bias-free guidance adaptive scheduling responsive to real-world conditions reverse mentorship for mutual knowledge exchange and a collaborative community impact hub for social projects.

Keywords: Personalized Learning AI Technology Alumni Network Career development Academic Success

IMAGE STEGANOGRAPHY USING PYTHON

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Abstract: In today's digital age the need for secure communication has become more critical than ever. While cryptography protects the contents of messages steganography goes one step further by hiding the existence of the message itself. This project focuses on implementing Image Steganography using Python where a secret message is embedded within a digital image without visibly altering the image's appearance. The method employed is based on the Least Significant Bit (LSB) technique where the binary data of the secret message is hidden in the least significant bits of the image pixels. This approach ensures that the image remains visually unchanged to the human eye while securely concealing the information. Python's PIL (Pillow) library is used to process the images offering an efficient and straightforward way to perform encoding and decoding operations.

Keywords: Image Steganography Data Hiding Least Significant Bit (LSB)Python PIL (Pillow) Library Digital Image Processing

AI-DRIVEN PIPELINE FOR ENVIRONMENTAL DNA (EDNA) ANALYSIS FOR BIODIVERSITY MONITORING IN AQUATIC ECOSYSTEMS

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Abstract—Environmental DNA (eDNA) analysis has emerged as a transformative non-invasive molecular approach for quantifying biodiversity and assessing ecosystem integrity. This study presents an AI-augmented bioinformatics pipeline that integrates high-throughput sequencing metagenomic assembly and machine learning-based taxonomic classification to enhance the detection and interpretation of eDNA signals in aquatic ecosystems. DNA fragments shed by organisms were extracted and sequenced using next-generation sequencing (NGS) technologies followed by feature engineering on k-mer profiles and environmental metadata. Supervised learning algorithms including random forest and convolutional neural networks were trained to classify taxa infer community structure and correlate species abundance with abiotic factors such as pH temperature and dissolved oxygen.

Keywords: Environmental DNA (eDNA) Biodiversity Monitoring Aquatic EcosystemsMachine Learning Artificial Intelligence Species Detection Bioinformatics Ecosystem Health Assessment Genetic Sequencing Conservation Biology.

REAL-TIME PUBLIC TRANSPORT TRACKING FOR SMALL CITIES

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Abstract:Public transport in small cities and tier-2 towns often suffers from unpredictable schedules lack of real-time information and limited digital infrastructure. This leads to commuter inconvenience overcrowding wasted time and reduced trust in public transport systems. To address this challenge we propose a real-time public transport tracking system that leverages GPS-enabled devices on buses and a mobile/web application for commuters. The system provides accurate real-time bus location updates estimated arrival times and route details helping commuters plan their journeys efficiently. For operators the solution enables better fleet management reduces idle times and improves overall service reliability. Unlike existing solutions designed for large metropolitan areas this project focuses on affordable scalable and infrastructure-light implementations suitable for small cities.

Keywords: Real-time tracking public transport GPS monitoring IoT small cities route optimization passenger information low-cost solution google map API

FAKE PRODUCT DETECTION USING BLOCKCHAIN

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Abstract:Fake items posture noteworthy financial misfortunes and dangers to shopper security over different businesses. Conventional anti-counterfeiting measures such as visualizations and serial numbers have demonstrated deficiently. This paper investigates how blockchain innovation can address the fake issue more successfully. By leveraging blockchain's decentralized record and cryptographic security a morally sound and straightforward record of each step in the supply chain is made. Interesting item identifiers on this tamper-resistant stage empower exact verification cultivating shopper believe. Savvy contracts inside the blockchain biological system robotize confirmation forms decreasing human mistake and streamlining exchanges. The proposed framework includes enrolling producers on the blockchain organize allotting special QR codes to items and making shrewd contracts for item possession exchange. Shoppers can confirm item realness through a portable application.

Keywords: Anti-counterfeiting Blockchain Customer believe Supply chain perceivabilityTamper-resistant

SELF-HEALING DATABASES USING AI-POWERED DATA ANOMALY RENERATION

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Abstract:In modern data-driven environments, maintaining database integrity and consistency is a critical challenge due to data corruption, transmission errors, or unexpected system failures. Traditional recovery mechanisms rely heavily on static backups and transaction logs, which often result in data loss or partial restoration. This paper proposes a novel self-healing database architecture that employs AI-powered anomaly detection and data regeneration techniques to autonomously identify, reconstruct, and validate corrupted or missing records. The proposed system integrates a machine learning engine trained on relational dependencies, temporal patterns, and semantic correlations across database entities. When an anomaly is detected, the AI model predicts the most probable values for missing or inconsistent entries using context-aware inference and pattern-based learning. The healing process operates in real time, minimizing downtime and human intervention while preserving ACID properties.

Keywords: Real-time tracking public transport GPS monitoring IoT small cities route optimization passenger information low-cost solution google map API

A NOVEL EXPLAINABLE AI FRAMEWORK FOR EARLY LUNG ABNORMALITY DETECTION FROM CHEST CT

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Abstract:Early and accurate detection of lung abnormalities is critical for effective diagnosis and treatment of respiratory diseases. Traditional imaging analysis techniques often rely heavily on expert interpretation, which can be time-consuming and prone to variability. This paper introduces PulmoXAI, a novel Explainable Artificial Intelligence (XAI) framework designed for the early detection of pulmonary abnormalities using chest Computerized Tomography Scan (CT) and X-ray images. PulmoXAI integrates advanced deep learning models with explainability modules to provide not only high diagnostic accuracy but also interpretable visual and textual explanations for clinical decisions. The framework employs a hybrid approach combining convolutional neural networks (CNNs) for feature extraction and attention-based mechanisms to highlight regions of clinical significance. Extensive experiments on publicly available and proprietary datasets demonstrate that PulmoXAI achieves superior performance compared to conventional methods while ensuring transparency, aiding radiologists in reliable and faster decision-making

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CSE(CS)-INT52	PRIVACY-PRESERVING MACHINE LEARNING IN MEDICAL	MRS.HARSHA.N, SHAFNA NAZAR, SWATHI SUNIL, DIYA SANTOSH
CSE(CS)-INT53	OFFLINE EMERGENCY CONTACT-WEB	DR. A. T. RAVI , SOWBARNIKA K, AISHWARYA S , MADHUSRI K
CSE(CS)-INT54	MENTAL HEALTH MONITORING SYSTEM	MR RAMAJAYAM N, SURIYA I , RUPESH S
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CSE(CS)-INT61	AI BASED MENTAL HEALTH SUPPORT CHAT BOT	MRS.HARSHA N , VIGNESH PRAKASHI, NAVANEETH G, KRISHNADEV G
CSE(CS)-EXT01	CLOUD SECURITY	SAM JOHN PAUL D, SANJAY PRIYADARSAN K, DHARSHANA A K , HARSHA V
CSE(CS)-EXT02	A DECENTRALIZED BLOCKCHAIN FRAMEWORK FOR BLUE CARBON MRV WITH UAV-LIDAR AND MACHINE LEARNING	JEJO J, GREESHMA YASHMI, AVITHRA M, PRIYADHARSHAN V, FEDRINA A
CSE(CS)-EXT03	AI-ENHANCED CREDENTIAL LEAK DETECTION AND ENCRYPTION FRAMEWORK FOR SECURE SOURCE CODE REPOSITORIES	KRITHIKA S, JEEVANTHAM S
CSE(CS)-EXT04	BLOCKCHAIN AND AI ENABLED DIGITAL TWIN ARCHITECTURE WITH IoT INTEGRATION FOR CYBER SECURITY APPLICATIONS	SATHISH P, RAGAVAN S, JEEVANANTHAM S, PRITHIBA V, MEISURYA V

ZERO TRUST VOICE BIOMETRIC WITH VOICE AUTHENTICATION

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Abstract—The rapid digital transformation across industries has intensified cybersecurity risks, making conventional perimeter-based defenses and static authentication systems insufficient to prevent sophisticated attacks. Existing reliance on passwords, tokens, and one-time passcodes has repeatedly proven vulnerable to phishing, credential theft, and social engineering, while even widely adopted multi-factor authentication models struggle against insider threats and adaptive adversaries. These challenges highlight the need for more robust and continuous verification mechanisms that extend beyond the initial login stage. Zero Trust security, based on the principle of “never trust, always verify,” has emerged as a critical paradigm, yet its effectiveness is limited when combined with traditional authentication factors alone.. This approach offers significant potential across high-security sectors including digital banking, healthcare, cloud infrastructures, and government systems, where both convenience and reliability are paramount. While practical deployment requires addressing issues such as environmental noise and spoofing resistance, the integration of voice biometrics into Zero Trust architectures presents a scalable, user-friendly, and forward-looking pathway to strengthening defenses against evolving cyber threats.

Keywords— *Zero Trust Security, Voice Biometrics, Continuous Authentication, Cybersecurity, Machine Learning, Phishing Prevention*

WEB RAPTOR: A UNIFIED URL RECONNAISSANCE PLATFORM FOR THREAT INTELLIGENCE AND VULNERABILITY MAPPING

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Abstract--: Web reconnaissance is a crucial phase in both offensive and defensive cybersecurity operations. It involves gathering publicly available information about a target system, domain, or infrastructure to identify potential vulnerabilities and exposure points before conducting assessments. Manual reconnaissance—while accurate—often requires repetitive steps across various tools such as Sublist3r, Amass, Nmap, VirusTotal, and WHOIS lookups, demanding a high level of human intervention and analytical consolidation. Web Raptor consolidates different reconnaissance tools and threat-intelligence APIs into a single automated pipeline and now integrates Nessus for authenticated and unauthenticated vulnerability scanning. students.

Keywords— *Web Raptor, URL Reconnaissance, Subdomain Enumeration, Threat Intelligence, OSINT Automation, VirusTotal, URLVoid, Vulnerability Scanning, Nessus*

STOPPHISHNOW: ANTI-PHISHING APPLICATION USING VITUSTOTAL API KEYS.

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Abstract - Phishing is among the main concerning problems in a constantly changing world. As the Internet becomes more popular, it has created new ways for people to steal personal information, called cybercrime. Cybercrime involves taking private data and breaking into people's privacy using computers. One of the main methods used in cybercrime is phishing. Phishing through URLs is a very common type, and its main purpose is to get users to visit a harmful website, which then steals their information. Finding a malicious URL is a significant challenge. This work aims to provide a solution for detecting such websites with the help of machine learning algorithms focused on the behaviour and qualities of the suggested URL. The web security community has created blacklisting services to identify malicious websites. The project utilizes a Flask backend framework to create a server that checks if a given link is malicious using VirusTotal API keys. The frontend is built with HTML and CSS. VirusTotal's public API is integrated into the Flask backend to detect malicious activities in submitted links.

Keywords—API Keys, Flask Backend, VirusTotal

STOCK PRICE TRACKER

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Abstract—The dynamic character of international financial markets imposes the need for efficient and precise tracking of the stocks' prices for well-informed investment, analysis, and research decisions. This paper focuses on both the technical underpinnings and practical application of such systems, followed by concentration on methodologies such as time series analysis, machine learning, and the incorporation of market sentiment for real-time detection and prediction. Additionally, this paper explores the accuracy and practicability of contemporary stock price monitors, illustrating the shift from past models, such as Bachelier's random walk hypothesis, to current sophisticated forecasting strategies. Our results reveal that the synergy of big data sources and deep learning power tremendously boosts forecasting ability, user interest, and entire market transparency alongside highlighting chronic challenges in data quality and volatility. This research seeks to lay a firm groundwork for future innovations in financial analysis and smart market monitoring.

Keywords—Stock price tracking, Real-time monitoring, Time series analysis, Machine learning, Market sentiment, Bachelier's random walk hypothesis, Financial forecasting

SOULSCAN: AI-POWERED SUICIDE RISK DETECTION AND PREVENTION FROM DIGITAL FOOTPRINTS

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Abstract— Social media is deeply woven into modern life, but constant exposure to negative or emotionally heavy content can quietly affect mental well-being, often leading to stress, anxiety, depression, and in extreme cases, suicidal thoughts. Existing tools—such as screen-time trackers or simple sentiment monitors— offer limited real-time help when it matters most. SoulScan is an AI-powered wellness platform designed to proactively detect and prevent emotional distress, including suicide risks. By analysing social media posts, captions, comments, emoji’s, and behavioural patterns such as posting frequency and timing, SoulScan generates a three-level risk score: Low, Moderate, or High. An interactive dashboard displays wellness scores and trends, while high-risk alerts trigger supportive actions such as real-time chat, online counselling, guided relaxation, and access to mental health resources. Continuous monitoring ensures follow-up support, bridging the gap between detection and meaningful intervention. By integrating early detection with timely support, SoulScan provides a proactive, accessible, and compassionate approach to digital wellness, helping users manage emotional challenges and prevent suicide.

Keywords—Artificial Intelligence, Digital Foot Prints, Mental Health, Social media analysis, Suicide Prevention

REVOLUTIONIZING URBAN WASTE MANAGEMENT WITH AI

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Abstract—Waste management in urban and industrial environments faces challenges such as overflowing bins, irregular collection, poor recycling practices, and illegal dumping. This project proposes an AI-powered Monitoring Assistant for Waste Management that integrates Internet of Things (IoT) sensors, computer vision, and predictive analytics to streamline waste handling. Smart bins equipped with IoT sensors track fill levels in real-time and transmit data to an AI-driven dashboard. The system leverages AI route optimization to prioritize urgent collections and generate the most efficient paths for garbage trucks, reducing operational costs, fuel consumption, and time. Image recognition technology further enhances efficiency by classifying waste into biodegradable, recyclable, or hazardous categories, enabling better segregation at the source., ensuring immediate intervention and compliance with safety regulations.

Keywords— Waste Management System , Sustainable Cities , Hazardous waste detection , Real Time Monitoring , Image Recognition ,IOT(Internet Of Things) , AI (Artificial Intelligence)

REAL-TIME SECURE AUTHENTICATION USING BEHAVIOURAL BIOMETRICS FOR USER AUTHENTICATION

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Abstract—In today’s digital-first world, securing user identity has become more critical than ever before. Traditional authentication methods such as passwords, PINs, and one-time passwords (OTPs) are no longer sufficient. They can be easily guessed, stolen, or compromised through phishing attacks, brute force attempts, or social engineering techniques. As cyber threats evolve, we need a smarter and more adaptive approach to protecting user accounts and sensitive data. This project introduces a smarter, more adaptive solution: a Java-based authentication system that integrates behavioral biometrics to verify users in real time. Instead of relying on static credentials, the system observes how users interact with their devices—tracking patterns like typing speed, typing rhythm, mouse movement patterns, click timing, scrolling style, and even subtle traits such as eye blink frequency or unique eye movement patterns. These behaviors are unique to each person and much harder to fake. By continuously monitoring these traits during login, the system builds a personalized profile for each user. Since these behaviors are highly individual and difficult to replicate, they provide a stronger layer of security. The core intelligence of the system lies in machine learning. By training on each user’s behavioral data, the system learns to build a personalized profile.

Keywords—*Biometric Authentication, User identity, Typing rhythm, Eye movement patterns, Real-time verification.*

PREDICTIVE CYBERSECURITY THREAT DETECTION USING MACHINE LEARNING

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Abstract—The rapid increase in cyberattacks has made traditional rule-based security systems inadequate to counter evolving threats. Modern attackers often exploit zero-day vulnerabilities, phishing campaigns, and sophisticated malware that bypass conventional defenses. To address these challenges, this paper explores the application of Machine Learning (ML) techniques for predictive cybersecurity threat detection. By training supervised and unsupervised learning models on network traffic logs and threat intelligence datasets, the system can identify hidden patterns and anomalies that indicate potential intrusions. Unlike static approaches, ML-based methods continuously improve by learning from new data, making them highly adaptable to emerging attack vectors. The proposed framework focuses on reducing false positives, improving detection accuracy, and enabling near real-time monitoring of suspicious activities. Expected outcomes include enhanced intrusion detection, proactive identification of threats before they cause damage, and scalable deployment in enterprise environments.

Keywords—*Biometric Authentication, User identity, Typing rhythm, Eye movement patterns, Real-time verification.*

POST-QUANTUM SECURE COMMUNICATION: A PRACTICAL PROTOTYPE WITH NIST-STANDARDIZED ALGORITHMS

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Abstract—The rapid advancement of quantum computing poses a serious risk to classical public-key cryptographic systems such as RSA and Elliptic Curve Cryptography (ECC), which can be efficiently broken using quantum algorithms like Shor’s algorithm. This project presents the design and prototype of a quantum-resistant secure communication system that integrates Post-Quantum Cryptography (PQC) algorithms standardized by NIST. The system employs the lattice-based CRYSTALS-Kyber algorithm for key exchange and CRYSTALS- Dilithium for digital signatures to ensure end-to-end confidentiality and authentication even against future quantum adversaries. A hybrid approach is used to maintain compatibility with existing infrastructure while transitioning to quantum-safe security. Performance analysis demonstrates that the proposed solution provides robust protection with practical key generation and encryption times suitable for real-world applications. This work highlights a viable pathway for organizations and developers to achieve long-term data security in the impending quantum era.

Keywords—Post-Quantum Cryptography (PQC), Quantum-resistant security, Lattice- based cryptography, CRYSTALS-Kyber, CRYSTALS-Dilithium, Hybrid cryptographic systems, Secure communication

OPTIMIZED TRANSFORMER FRAMEWORK FOR COMPREHENSIVE QUESTION ANSWERING IN OPEN DOMAINS

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Abstract—Open-domain Question Answering (QA) requires models capable of retrieving, integrating, and reasoning over massive, heterogeneous knowledge sources. Traditional Transformer-based approaches achieve high accuracy but face challenges such as high computational overhead, shallow reasoning, and inefficient handling of diverse knowledge formats. This paper introduces an Optimized Transformer Framework (OTF) for comprehensive open-domain QA, combining several novel strategies. A Dynamic Knowledge Routing Mechanism (DKRM) hierarchically organizes and routes attention to the most relevant knowledge clusters, cutting redundant computations. A Hybrid Retrieval-Augmented Generation (HRAG) module fuses sparse and dense retrieval while leveraging an adaptive memory cache for real-time integration of structured and unstructured information. To enhance logical inference, a Reasoning-Aware Multi-Stage Attention (RAMSA) layer aligns intermediate attention patterns with self-supervised reasoning signals, improving multi-hop reasoning capabilities. Finally, a progressive parameter quantization scheme and low-rank adaptation layers reduce training and inference costs without loss of accuracy.

Keywords—Open-domain question answering, Optimized Transformer, Dynamic Knowledge Routing, Retrieval-Augmented Generation, Multi-hop reasoning, Low-rank adaptation,

NEURO AI: BRAINWARE-POWERED HUMAN MACHINE INTERFACE (BPHMI)

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Abstract—The rapid convergence of neuroscience and artificial intelligence has opened pathways to create intuitive human-machine interactions. Neuro AI brainware powered human interfaces leverage brain-inspired computing models and advanced neural signal processing to bridge cognitive functions with digital systems. By decoding brain activity and integrating it with adaptive AI algorithms, such interfaces enable seamless communication, control, and augmentation of human capabilities. Applications range from healthcare—such as neuroprosthetics, rehabilitation, and early detection of cognitive disorders—to immersive experiences in education, entertainment, and human-robot collaboration. Unlike traditional input devices, brainware interfaces prioritize natural, thought-driven interaction, reducing latency between intention and action. This paradigm not only enhances accessibility for individuals with disabilities but also redefines productivity and creativity in broader domains. Ultimately, Neuro AI interfaces signify a transformative leap toward symbiotic human-AI ecosystems, where machines adapt to human intent at the speed of thought.

Keywords— *Brain ware computing-based interface, Cognitive computing, Neural interface, Brainwave coding, Thought control system, Neural signal interface*

MONITORING SYSTEM AND SECURITY USING KEYLOGGER

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Abstract— In today’s digital era, organizations increasingly rely on advanced technologies such as internet monitoring tools, email surveillance systems, network analyzers, and keylogging software to track employee activities on computers and communication platforms. With the rapid adoption of cloud-based services, instant messaging, and remote work, these technologies have become central to maintaining productivity, securing information, and protecting organizational resources. However, the growing sophistication of monitoring systems also raises significant challenges. Many employees perceive constant surveillance as intrusive and demoralizing, while organizations justify it as a necessary tool for ensuring security, compliance, and efficiency. This tension highlights the need to balance organizational interests with individual rights. To address these concerns, keylogging and monitoring solutions can be enhanced with intelligent analytics, transparency policies, and ethical frameworks. Instead of simply recording activities, modern systems can be designed to provide actionable insights—highlighting patterns of misuse while respecting user privacy through anonymization and selective reporting.

Keywords— *Email monitoring, Internet monitoring, Computer monitoring, Chats/IM is monitoring, Network monitoring, Document monitoring, Web site monitoring, Productivity monitoring, keylogging.*

LOGIN BRUTE FORCE PROTECTOR USING REDIS DATABASE

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Abstract—In today’s digital era, authentication systems face increasing threats from brute-force and credential-stuffing attacks, where attackers attempt large numbers of username and password combinations to gain unauthorized access. This project focuses on the design and development of a Login Brute-Force Protector Module, a security mechanism that prevents malicious login attempts while ensuring minimal disruption for genuine users. The module integrates multiple protection strategies including per-IP rate limiting, account-based lockouts with exponential backoff, and global request throttling, implemented using Python Flask and Redis for real-time monitoring and state management. Additionally, the system incorporates logging and alerting features for forensic analysis and provides an admin interface for monitoring blocked accounts and IP addresses. By automating detection and response against abnormal login behaviors, the proposed solution effectively reduces the risk of account compromise, enhances authentication security, and supports safer user experiences.

Keywords—Brute-force attack, Authentication Security, Rate Limiting, Exponential Backoff, Python Flask, Redis

INTRUSION DETECTION SYSTEM USING AI-ML

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Abstract—Intrusion Detection System using AI and Machine LearningIn the modern digital landscape, the escalating volume and sophistication of cyberattacks present a significant challenge to network security. Traditional Intrusion Detection Systems (IDS), which primarily rely on signature-based methods, are becoming increasingly ineffective against zero-day attacks and polymorphic threats. This paper proposes a novel approach to network security by leveraging Artificial Intelligence (AI) and Machine Learning (ML) to develop an advanced, anomaly-based Intrusion Detection System.The proposed system utilizes a multi-layered model incorporating supervised and unsupervised machine learning algorithms to analyze real-time network traffic. By training on vast datasets of both normal and malicious network behaviors, the system can dynamically identify and classify anomalous activities that deviate from established baselines. Key techniques such as Random Forest, Support Vector Machines (SVM), and deep neural networks are employed to enhance detection accuracy and minimize false positives.

Keywords—Intrusion Detection System (IDS),Signature-based Methods,NetworkSecurity,Anomaly-based Detection,Cyberattacks,DetectionAccuracy,False Positives, Zero-day Attacks.

IDENTIFICATION OF MALICIOUS FILE USING HEX VALUES

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Abstract—The rapid dependence on digital platforms in recent years has simultaneously increased the scale and sophistication of cyber threats. Malicious actors are continually developing advanced the integrity of data. Conventional malware detection mechanisms, especially those built primarily on signature matching, often fail to keep pace with these evolving threats.. This study explores malicious file detection by analysing hexadecimal (hex) values, which directly represent the binary foundation of digital files. By identifying irregular patterns, uncommon byte sequences, and structural anomalies within these values, it becomes possible to classify files as benign or malicious with greater precision. The proposed methodology involves converting files into their hex form, structuring the extracted data, and applying both statistical methods and machine learning algorithms to uncover deviations from expected characteristics. Such an approach is highly effective against malware families that employ polymorphism, encryption, or obfuscation to avoid conventional defences.

Keywords—*Malware detection, Hexadecimal analysis, Cybersecurity, Machine learning, Static analysis, Obfuscation, Polymorphic malware, File classification*

HYBRIDE WIRELESS SECURITY SYSTEM USING IoT AND MULTI-PROTOCOL

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Abstract — In an era where security is a growing concern for both residential and commercial spaces, the integration of Internet of Things (IoT) technologies has opened new possibilities for intelligent, real-time surveillance systems. This project proposes an efficient hybrid wireless security system utilizing IoT devices and multiple wireless communication protocols to ensure enhanced security, reliability, and scalability. The system incorporates a variety of sensors—including motion detectors, magnetic door/window sensors, and vibration sensors—connected via low-power wireless protocols such as Zigbee and Bluetooth Low Energy (BLE). For high-bandwidth components like video surveillance, Wi-Fi is employed, while LoRa technology is used for long-range, low-power communication in outdoor environments. A GSM/4G module serves as a backup communication channel to ensure critical alerts are always delivered.

Keywords — *Hybrid Wireless Security, System Internet of Things (IoT), Multi-Protocol Communication, Edge Computing, Intrusion Detection, Low-Power Wireless Protocols, AI-Based Video Analytics*

HASHGUARD:A NOVEL INTEGRITY VERIFIER

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Abstract—In today’s digital ecosystem, the protection of data authenticity and security has become a critical concern, with technologies such as cryptographic hashing (MD5, SHA-1, SHA-256, SHA-512) and real-time file verification emerging as the standard tools to detect tampering, corruption, and unauthorized alterations. These technologies empower organizations and individuals to preserve the accuracy and reliability of their digital assets while ensuring compliance with established data protection frameworks. Despite these advancements, significant challenges persist. File systems remain vulnerable to sophisticated cyberattacks, insider threats, and unintentional data corruption. Traditional approaches to integrity verification, while effective, can struggle with scalability, speed, and adaptability in cloud environments or large-scale infrastructures where massive volumes of data are constantly processed and stored. The prevailing culture in digital security emphasizes reactive measures rather than proactive protection.

Keywords—File Integrity, Data Security, Cryptographic Hashing, MD5, SHA1, SHA256, SHA512, Data Authenticity, Tamper Detection, File Verification.

FILE TRUST CHECKER USING SHA-256 AND BLOCKCHAIN TECHNOLOGY

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Abstract—In the digital era, ensuring the integrity and authenticity of files is critical for maintaining trust and security in data exchange. This project presents a File Trust Checker that combines SHA-256 hashing and blockchain technology to provide a robust mechanism for file verification. The system computes a unique SHA-256 hash for each file, which serves as a digital fingerprint, and records this hash on a blockchain - a decentralized and tamper-resistant ledger. Each block in the blockchain contains metadata about the file, including its name, hash, timestamp, and the hash of the previous block, ensuring immutability and traceability. By cross-verifying the computed file hash against the blockchain records, users can detect any unauthorized modifications, thereby ensuring the file’s authenticity and integrity. This approach leverages the cryptographic strengths of SHA-256 alongside blockchain’s secure data structure to build a trustworthy file verification system applicable to various domains, including software distribution, legal documentation

Keywords—File Integrity, Python, Cryptographic Hashing, SHA-256, Cybersecurity, Blockchain Technology

FEDERATED PERSONALIZED LEARNING WITH PRIVACY GUARANTEE

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Abstract—Federated learning has emerged as a powerful approach to train machine learning models without centralizing sensitive data. In this method, individual devices or local nodes collaborate by sharing model updates rather than raw information. Personalized learning within federated systems aims to adapt models to individual user preferences and contexts. This is particularly important because one global model often fails to meet the diverse needs of users. By combining federated learning with personalization, the system ensures better accuracy and user satisfaction. At the same time, privacy becomes a key challenge because data remains distributed across multiple devices.. These methods prevent sensitive information leakage while still enabling effective learning. Personalized federated learning with privacy guarantee finds applications in healthcare, education, mobile services, and smart devices.

Keywords—*federated learning, personalized learning, privacy guarantees, differential privacy, Distributed training, data privacy, user-centric AI, communication efficiency*

FEDERATED LEARNING IN EMERGENCY SITUATIONS

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Abstract—Emergency situations such as natural disasters, pandemics, and critical infrastructure failures demand rapid decision-making and secure data sharing across multiple organizations. Traditional centralized machine learning approaches face limitations due to privacy concerns, communication overhead, and lack of real-time adaptability. This paper explores the application of Federated Learning (FL) in emergency response systems, where data remains decentralized at edge devices while collaborative models are trained across distributed nodes. The proposed framework leverages FL to integrate heterogeneous data from hospitals, government agencies, and IoT-enabled devices without exposing sensitive information. By reducing dependency on central servers, the system enhances resilience against communication breakdowns and cyber threats. Furthermore, the use of lightweight aggregation algorithms and adaptive communication protocols ensures efficient model updates bandwidth-constrained environments.

Keywords—*Federated Learning, Emergency Response, Privacy Preservation, IoT, Disaster Management.*

ETHICAL KEYLOGGERS APPLICATION ACTIVITIES IN CYBER SECURITY

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Abstract— Cyber attackers are always seeking to design and push malicious software programs to unsuspecting users, to intentionally steal or cause damage and exploit data on end user systems. Malware types include spyware, keyloggers, rootkits and adware. In the past, script kiddies hacked computers to show off their skills and have fun. Today, hacking computers has become a huge cybercrime industry. Even as systems have improved in terms of both hardware and software, cyber attacks continue unabated. Keyloggers are kind of a rootkit malware that catch composed keystroke occasions of the console and save into log record, hence, it can capture delicate data, for example, usernames, PINs, and passwords, in this manner communicates into vindictive assailant without pulling in the consideration of clients. This paper presents an outline of Keyloggers programs, types, qualities of Keyloggers and philosophy they use. At last we will break down the current discovery procedures, and investigate a few proactive methods.

Keywords—*Malicious software, Malware, Spyware, Keyloggers, Rootkits*

ENHANCING BIOMETRIC SECURITY THROUGH FACE ANTI- SPOOFING TECHNIQUES

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Abstract—Facial recognition systems have become increasingly prevalent in biometric authentication due to their user-friendliness and efficiency; however, their widespread adoption has raised significant concerns about security vulnerabilities, particularly spoofing attacks. These attacks, including the use of printed photos, replayed videos, and 3D masks, can easily deceive systems that lack effective liveness detection. This research aims to enhance biometric security by developing advanced face anti-spoofing techniques capable of accurately distinguishing between genuine and fake face inputs. The study explores both traditional and deep learning-based methods, focusing on Convolutional Neural Networks (CNNs), Vision Transformers (ViTs), and hybrid architectures that extract spatial and temporal features indicative of spoofing. Additionally, texture analysis, motion patterns, and depth estimation are integrated to improve detection robustness. The models are trained and evaluated on widely recognized datasets such as CASIA-FASD, Replay-Attack, and Celeb-Spoof, ensuring generalization across diverse spoofing scenarios and environmental conditions.

Keywords—*Biometric-Authentication, Convolutional Neural-Network(CNNs), Vision Transformers, CelebA-Spoof.*

EDGE AI FOR EMERGENCY RESPONSE

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Abstract—Edge AI is changing the way we use artificial intelligence by bringing it closer to where data is actually created right at the edge of the network. Instead of sending everything to the cloud, Edge AI allows devices like smartphones, sensors, or cameras to process data and make decisions in real time. This paper takes a closer look at what Edge AI is, how it works, and where it's being used. It explores different system designs like Client- Server, Federated Learning, Pipeline, Distributed, and Hierarchical models, which support various ways to handle data and run AI tasks. It also looks at popular tools like TensorFlow Lite, PyTorch Mobile, ONNX, and OpenVINO that help developers build and run AI models on edge devices. Edge AI offers several benefits—it's faster, more secure, saves bandwidth, and works even when internet connections are spotty. It's being used in many areas, including healthcare, smart homes, industrial IoT, self-driving cars, and retail.

Keywords— *Edge AI, Edge Computing, On-device AI, Federated learning, Real-time inference.*

DIGITAL PRIVACY IN THE AGE OF AI SURVEILLANCE

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Abstract—In the age of artificial intelligence (AI), surveillance technologies have reached unprecedented levels of sophistication, raising critical concerns about digital privacy. From facial recognition and predictive analytics to algorithm-driven data profiling, AI enables mass collection, analysis, and utilization of personal information at scales never before possible. This paper explores the evolving challenges of safeguarding digital privacy in the context of AI-driven surveillance, examining ethical implications, legal frameworks, and technological countermeasures. It highlights the urgent need for transparent policies, privacy-preserving AI models, and stronger regulatory mechanisms to balance innovation with fundamental rights. Ultimately, addressing digital privacy in the age of AI surveillance is not only a technical challenge but also a societal imperative to protect individual autonomy and democratic values.

Keywords—*Digital Privacy, AI Surveillance, Data Protection, Facial Recognition, Algorithmic Profiling, Data Security, Privacy-Preserving AI*

DETECTING PROMPT INJECTION IN GENERATIVE AI

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Abstract—The rapid adoption of large language models (LLMs) in chatbots, code assistants, and autonomous agents has introduced a critical security vulnerability known as prompt injection. In this attack, a malicious user embeds hidden instructions or manipulative text within prompts or external data, causing the generative AI system to ignore its original guidelines and perform unintended actions—such as leaking confidential information or executing harmful commands. This project proposes a prompt-injection detection framework that combines rule-based heuristics with a machine-learning classifier to accurately distinguish benign prompts from maliciously crafted ones. A curated dataset of normal and adversarial prompts is used to train and evaluate the model. Experimental results demonstrate high detection accuracy and low false-positive rates, providing an effective defense layer that can be integrated into LLM-powered applications and API gateways. The proposed solution offers a practical pathway to strengthening the security of generative AI systems against emerging prompt injection threats.

Keywords—Prompt Injection, Generative AI Security, Large Language Models (LLMs), Adversarial Prompts, Prompt-Injection Detection,

COGNITIVE-ORCHESTRATED VISUALIZATION AND COMMAND ARCHITECTURE FOR FEDERATED HYPERCOMPUTING ENVIRONMENTS WITH EMBEDDED AUTONOMOUS CYBER DEFENSE PROTOCOL

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Abstract—The exponential rise in computational demands across domains such as scientific research, industrial automation, and defense operations has intensified the need for streamlined management of supercomputing resources. As these systems grow in scale and complexity—often spanning multiple geographic locations—the challenge lies in maintaining operational efficiency, security, and real-time visibility across distributed environments. This paper introduces a Unified Display Control Architecture (UDCA), a centralized framework designed to monitor and manage supercomputing clusters through a single, interactive interface. The architecture provides dynamic visualization of system performance, workload allocation, and inter-node communication, enabling administrators to oversee operations with precision and agility. Its modular design supports integration with diverse hardware configurations and software ecosystems, making it adaptable to a wide range of high-performance computing (HPC) infrastructures.

Keywords—Raspberry PI, Secure shell, Kerberos, Supercomputers, KVM over IP

BLOCKCHAIN-ENABLED SECURE FILE TRANSFER USING ZERO-KNOWLEDGE PROOFS

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Abstract—In today’s digital ecosystem, where secure data exchange is fundamental to organizational operations, the limitations of traditional centralized file-sharing platforms—such as single points of failure, inadequate privacy guarantees, and challenges in regulatory compliance—have become increasingly evident. To address these issues, this paper proposes a decentralized framework for file transfer that integrates blockchain technology, distributed storage (IPFS), robust encryption, and zero-knowledge proofs. Within the system, files are encrypted with AES-256, divided into fragments, and stored across a peer-to-peer IPFS network. Metadata and access permissions are immutably maintained on the blockchain, while zero-knowledge proofs (zk-SNARKs) enable verification of user authorization and file integrity without disclosing the underlying data. Smart contracts facilitate autonomous access control and validation, ensuring a secure and trustless transfer process.

Keywords—Blockchain, Zero-Knowledge Proofs, Secure File Transfer, IPFS, Smart Contracts, Data Privacy, Decentralized Storage, End-to-End Encryption.

BLOCKCHAIN FORENSIC FOR CRYPTOCURRENCY TRANSACTION INVESTIGATION

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Abstract—The rapid growth of cryptocurrencies has transformed global finance by enabling borderless, transparent, and decentralized transactions. While this brings efficiency and innovation, it also creates risks. The pseudo-anonymous nature of blockchain networks has provided opportunities for money laundering, ransomware attacks, and terrorist financing. Traditional digital forensic methods often struggle to address these challenges because of the distributed and hard-to-alter features of blockchain technology. To address this gap, blockchain forensics has emerged as a field dedicated to tracing, analyzing, and interpreting cryptocurrency transactions. This study explores its practical applications in monitoring cryptocurrency flows, identifying wallet owners, and detecting suspicious activity patterns. Techniques such as ledger data analysis, wallet clustering, transaction graph mapping, and AI-driven anomaly detection are applied to uncover hidden links between addresses and trace illicit funds

Keywords—Blockchain forensics, Cryptocurrency transactions, Wallet clustering, Transaction graph mapping, Anomaly detection, Digital forensics, Blockchain technology, Financial crime

AUTONOMOUS SELF-HEALING NETWORK DEFENSE SYSTEM WITH REAL-TIME THREAT NEUTRALIZATION

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Abstract—With the rise of sophisticated cyberattacks, conventional defenses often fail to deliver adaptive protection. This paper proposes an Autonomous Self-Healing Network Defense System with real-time threat neutralization. The framework leverages machine learning (ML) for anomaly detection, dynamic threat classification, and predictive analytics, enabling early identification and mitigation of attack patterns. An AI-driven self-healing architecture automatically restores compromised nodes by reconfiguring network paths and patching vulnerabilities without human intervention. Prototype evaluation shows improved adaptability, minimal downtime, and faster recovery compared to traditional solutions. This study demonstrates the potential of integrating AI, ML, and self-healing mechanisms to achieve resilient, autonomous, and trustworthy cybersecurity systems.

Keywords— *Network Defense, Self-Healing, Machine Learning, Real-Time Threat Neutralization, Cybersecurity.*

AI-POWERED STRONG PASSWORD GENERATOR AND BREACH CHECKER

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Abstract— This project tackles the persistent risks of weak and reused passwords by combining an AI-driven generator with a privacy-preserving breach checker. A compact, on-device language model produces high-entropy, policy-compliant, and memorable passphrases (e.g., multi-word phrases with semantic constraints) while actively avoiding patterns common in leak corpora. Each candidate is scored with calibrated entropy and guess ability estimates aligned to NIST SP 800-63B guidance and real-world attacker models. Before use, passwords are checked against known breaches via k-anonymity (hash-prefix) queries so the plaintext never leaves the device. The system is offline-first, logs nothing, and provides clear “why this is strong” explanations to improve user trust and adoption. The MVP includes a web app and browser extension with site-aware policy templates, accessibility features, and localization.

Keywords— *AI-driven password generation , High-entropy passphrases, Password strength estimation, NIST SP 800-63B compliance ,Guess abilityanalysis ,*

AI-IN DISASTER MANAGEMENT FOR FLOODS AND EARTHQUAKE PREDICTION

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Abstract—Artificial Intelligence (AI) has emerged as a transformative tool in disaster management, particularly for predicting and mitigating the impacts of floods and earthquakes. By leveraging vast datasets from sensors, satellites, historical records, and IoT devices, AI algorithms can analyze complex patterns and provide early warnings with greater accuracy and speed. In the Context of flood prediction, AI models integrate rainfall data, river water levels, soil moisture, and climate patterns to forecast Flood risks, enabling timely evacuation and resource allocation. Similarly, for earthquake prediction, AI-driven systems analyze seismic signals, geological data, and micro-tremors to identify precursors of seismic activity, reducing the unpredictability traditionally associated with earthquakes. Beyond prediction, AI supports real-time decision- making, optimizing rescue operations, and managing relief distribution through intelligent simulations and automated mapping.

Keywords—*Artificial Intelligence (AI), Disaster Management, Flood Prediction, Earthquake Prediction, Early Warning Systems, Seismic Data Analysis, Climate Data, IoT Sensors, Risk Mitigation, Real-time Decision Making.*

AI-DRIVEN CYBER THREAT DETECTION AND DEFENCE SYSTEM

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Abstract— Cyber attacks are increasing in size and complexity, and conventional defence measures prove to be inadequate. Artificial Intelligence (AI) provides an active approach with smart threat detection and automated defence. AI-based systems leverage machine learning, deep learning, and behaviour analytics to monitor network traffic, detect anomalies, and react in real time. These systems enhance precision, scalability, and responsiveness while diminishing dependence on human monitoring. Although issues like adversarial attacks, data privacy, and explain ability persist, AI improves resilience to emerging cyber threats. Hence, AI-powered detection and defence systems are an essential step towards constructing secure, intelligent, and adaptive digital foundations systems.

Keywords— *Machine learning ,Real-time threat detection, AIsolutions, threatprotection , Deep learning.*

AI-BASED ADAPTIVE TRAFFIC SIGNAL CONTROL SYSTEM FOR SMART CITIES

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Abstract—Traffic congestion is a recurring issue in cities, causing longer travel time, fuel usage, and emissions. Conventional traffic signals follow pre-set timers that prove to be inefficient for regulating fluctuating traffic flow. This article suggests an AI-adaptive traffic signal control system that, on the basis of real-time traffic information, dynamically adjusts signal timing. Applying machine learning algorithms and sensor data, the system predicts traffic flow patterns and adjusts signal phases to minimize delays and increase traffic throughput. The method improves road safety, reduces congestion, and assists with the creation of smart city infrastructure. Simulation results show the method effectively manages traffic and decreases total delays, and its suitability for mass urban application. Furthermore, such systems can be integrated with vehicle-to-infrastructure (V2I) communication, allowing connected cars to interact directly with traffic signals.

Keywords-- Artificial Intelligence (AI), Adaptive traffic signal control, Traffic flow optimization, Road safety, Smart city infrastructure, Real-time traffic data, Sensor inputs.

AI POWERED PHISHING SIMULATOR AND DETECTOR

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Abstract—AI-powered phishing attacks have become increasingly sophisticated due to generative artificial intelligence, which enables attackers to craft highly personalized and convincing messages targeting individuals and organizations. To address this evolving threat landscape, this conference paper presents the design and development of an integrated AI-powered phishing simulator and detector that combines advanced simulation and real-time detection capabilities. The simulator employs deep learning and natural language processing to generate realistic phishing scenarios adapted to specific user roles, behaviors, and cultural contexts, facilitating effective security awareness training and risk assessment. This research highlights the critical role of AI-driven solutions in fortifying cybersecurity posture and suggests directions for scalable, adaptive defense mechanisms against evolving phishing techniques

Keywords— AI-powered phishing detection, phishing simulation, cybersecurity training, Real-time threat alerts, AI-driven email analysis, Automated phishing awareness.

AI POWERED DRONE FOR SMART AGRICULTURE & FOREST SURVEILLANCE

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Abstract—This project proposes an AI-driven Unmanned Aerial Vehicle (UAV) platform for high-precision agriculture and forest surveillance. The system integrates multi-spectral and thermal imaging sensors, GPS/IMU-based autonomous navigation, and edge-deployed deep learning models to enable real-time environmental intelligence. In agricultural settings, convolutional neural networks (CNNs) perform crop-health assessment, pest and disease detection, and soil-moisture estimation from normalized difference vegetation index (NDVI) and thermal maps, supporting data-driven irrigation and fertilization strategies. The UAV employs an autonomous flight planner optimized for coverage and energy efficiency using A-based path planning* and real-time obstacle avoidance with LiDAR fusion. Processed data are streamed to a cloud platform for predictive analytics and geospatial visualization, enabling stakeholders to make rapid, evidence-based interventions.

Keywords—AI-driven UAV, precision agriculture, forest monitoring, multi-spectral imaging, thermal sensing, convolutional neural networks (CNN),

AI DRIVEN IN MEDICAL ROBOTICS, DRUG DISCOVERY AND TELEMEDICINE

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Abstract— Artificial Intelligence (AI) is revolutionizing healthcare by enhancing precision, efficiency, and accessibility across multiple domains. In medical robotics, AI enables autonomous and semi-autonomous surgical systems that improve accuracy, reduce human error, and support minimally invasive procedures. Machine learning algorithms analyse real-time sensor data to guide robotic arms, adapt to patient-specific anatomy. AI accelerates the identification of potential therapeutic compounds by mining vast biological datasets, predicting molecular interactions, and simulating clinical responses. Telemedicine, empowered by AI, bridges geographical and resource gaps by offering intelligent diagnostic tools, virtual consultations, and personalized treatment plans, making it more proactive, personalized, and scalable. However, challenges remain in data privacy, algorithmic bias, and regulatory compliance. Addressing these concerns is essential to ensure ethical deployment and widespread adoption.

Keywords— Surgical Navigation, Realtime monitoring, Molecular docking, Remote Patient Monitoring, symptom checker

AETHEREYE: A NETWORK MONITORING APPLICATION

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Abstract—In today’s digital era, efficient monitoring of network activity is crucial for maintaining security, performance, and reliability. This project presents the development of a Network Monitoring Application designed to track, analyze, and visualize network traffic in real time. The primary objective of the application is to provide users with insights into bandwidth usage, active connections, and potential anomalies that may indicate security threats or performance issues. The application was developed using python language with scapy, numpy, matplotlib libraries, and it incorporates features such as live packet capture, protocol identification, and traffic statistics. A user-friendly dashboard enables administrators to monitor host activity, detect unusual patterns, and receive alerts when thresholds are exceeded. Testing on a local area network demonstrated the application’s ability to accurately capture traffic, identify protocols, and highlight abnormal activity. The results confirm that the tool can serve as a lightweight, cost-effective solution for small to medium-sized networks.

Keywords— *Scapy,numpy,matplotlib, capture traffic, intrusion detection, identify protocols*

A NOVEL APPROACH TO THREAT MODELING USING AI- DRIVEN AUTONOMOUS AGENTS

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Abstract—This study presents an agent-based framework for enterprise threat modeling that integrates autonomous, STRIDE-specialized agents to overcome the limitations of static models and traditional manual assessments in keeping pace with evolving attack surfaces. Each agent is assigned to one of the six STRIDE categories—Spoofing, Tampering, Repudiation, Information Disclosure, Denial of Service, and Elevation of Privilege—and becomes context- aware by analysing heterogeneous data sources, including architectural dependency graphs, historical security logs, software repositories, and curated vulnerability databases. Experimental results demonstrate improved detection of multi-stage and compound threats, while reducing false positives through agent specialization. Despite challenges such as sustaining performance under high-volume data, ensuring interpretability

Keywords— *Threat Modeling; Autonomous Agents; Cybersecurity; STRIDE; Anomaly Detection; Attack Chains*

A CASE-STUDY ON CYBER SECURITY FRAMEWORK IN AUTONOMOUS MOTORCYCLE

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Abstract—The rapid evolution of autonomous vehicles has introduced motorcycles as a new frontier in intelligent mobility. However, the integration of sensors, connectivity modules, and AI-driven decision systems makes autonomous motorcycles highly vulnerable to cyberattacks. This paper presents a cybersecurity framework specifically designed for autonomous motorcycles, ensuring safe navigation and rider protection against digital threats. The proposed framework employs multi-layered security mechanisms, including intrusion detection, encrypted communication between IoT modules, and real-time anomaly monitoring of control signals. A lightweight AI-based threat detection algorithm is incorporated to identify and mitigate potential attacks without compromising vehicle performance. The framework also secure firmware updates, enhancing overall system trustworthiness. Simulation and prototype testing highlight improved resilience against spoofing, denial-of-service, and malware attacks.

Keywords— *Autonomous Motorcycles, Cybersecurity Framework, IoT Security, AI Threat Detection.*

A BROWSER EXTENSION FOR DETECTION OF REFLECTED CROSS-SITE SCRIPTING ATTACKS IN REAL-TIME

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Abstract—Internet users worldwide are increasingly concerned about the impact of free services on their privacy and security. The Internet is a vast network of websites, most of which serve informative purposes, while others are service-oriented. Paid services often provide premium features for a cost, whereas free services appear to offer convenience without charge. However, the notion of “free” usually comes with hidden risks, particularly involving user data collection, tracking, and malicious activities. One of the pressing threats in this space is the exploitation of client-side vulnerabilities, such as Reflected Cross-Site Scripting (RXSS) attacks. These attacks allow malicious scripts to be injected into trusted websites, potentially stealing sensitive information or hijacking user sessions. To address this issue, a browser-based solution can provide effective protection in real-time.

Keywords — *Privacy, Security, RXSS (Reflected Cross-Site Scripting), SVM (Support Vector Machine), Browser Extension*

REVERSE ENGINEERING AND STATIC MALWARE ANALYSIS IN ANDROID APPLICATION

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Abstract— The rapid growth of Android applications has made smartphones an integral part of everyday life, but it has also increased the risk of malware attacks that compromise data privacy, device integrity, and user security. This paper presents an Android-based Malware Analysis Model designed to detect, classify, and analyze malicious applications efficiently. The model integrates both static and dynamic analysis techniques to examine application code, permissions, and runtime behavior. Static analysis focuses on manifest files, API calls, and permission usage, while dynamic analysis observes real-time execution patterns within a controlled environment to identify hidden or obfuscated threats. The proposed system leverages machine learning algorithms to enhance detection accuracy, reduce false positives, and adapt to evolving malware families.

Keywords— *Malware Analysis, Android application, Static Analysis, Malware Detection.*

AN EFFICIENT REAL-TIME MODEL FOR DEEPFAKE DETECTION USING MACHINE INTELLIGENCE

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Abstract—Deepfake technology, powered by advanced generative adversarial networks (GANs), poses severe risks to information integrity, privacy, and societal trust by enabling the creation of highly realistic manipulated videos and images. This paper proposes an effective real-time deepfake detection model leveraging machine intelligence through a hybrid convolutional neural network (CNN) architecture combined with long short-term memory (LSTM) layers, optimized for low-latency processing on resource-constrained devices such as mobile platforms. By employing lightweight backbones such as MobileNet for efficient feature extraction and transfer learning from pre-trained models, our approach addresses key challenges in scalability and generalizability, outperforming traditional methods in cross-dataset evaluations.

Keywords— *Deepfake Detection, Real Time Model, Digital Forensic.*

AI-POWERED TWO-WAY SIGN LANGUAGE COMMUNICATION SYSTEM USING DEEP LEARNING AND GENERATIVE AI

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Abstract—Sign language is a visual form of communication that relies on hand gestures and movements, serving as the primary language for individuals with hearing and speech impairments. United awareness and usage among the general population often create barriers in education, employment, and social life for the deaf community. Recent progress in artificial intelligence (AI) and deep learning provides effective solutions to reduce these barriers. This paper introduces an AI-powered two-way sign language translator that combines Automatic Speech Recognition (ASR), Natural Language Processing (NLP), and 3D gesture animation. The system converts spoken words into real-time sign gestures and also supports reverse translation, enabling seamless interaction between hearing and non-hearing individuals. Unlike traditional image processing approaches, neural network models achieve higher accuracy in recognizing and generating complex patterns. The proposed framework supports multiple spoken and sign languages, including regional variations, and is designed for mobile and web platforms to ensure wide accessibility.

Keywords— *Generative AI, Deep Learning, Neural Networks, NLP, ASR, Sign Language*

FUTURE COMPUTING POWERS- QUANTUM COMPUTING & QUANTUM INFORMATION

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Abstract: The convergence of Artificial Intelligence (AI), Machine Learning (ML), and advanced computing paradigms is reshaping the technological landscape at an unprecedented pace. As classical computing approaches their physical and architectural limits, the emergence of quantum computing offers a transformative leap in processing power, parallelism, and problem-solving capabilities. This hackathon explores the dynamic interplay between AI/ML and quantum technologies, focusing on how quantum computing and quantum information can redefine the future of intelligent systems. Participants will delve into quantum-enhanced machine learning models, quantum data encoding, and hybrid algorithms that leverage both classical and quantum resources. The event encourages innovation in areas such as quantum neural networks, quantum cryptography for secure AI, and optimization problems solvable only through quantum supremacy.

Keywords: *AI, ML, quantum computing, hybrid algorithms, quantum cryptography, neural networks, simulators, data encoding, optimization, supremacy, intelligent systems, pattern recognition, decision-making, quantum-AI integration, future tech*

VISION LANGUAGE ACTION MODELS FOR GENERALIST ROBOTICS

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Abstract: Vision-Language-Action (VLA) models are emerging as a promising foundation for creating generalist robots capable of adapting to a wide spectrum of tasks. Unlike conventional robotic frameworks that are narrowly designed for specific applications, VLA systems integrate three key modalities: visual perception, natural language comprehension, and action generation. This tri-modal synergy allows robots to interpret their surroundings, align observations with human instructions, and execute context-appropriate behaviors. Potential applications span household assistance, industrial automation, healthcare support, and autonomous exploration, highlighting their transformative value. Nevertheless, challenges such as safe deployment, real-world robustness, data efficiency, and ethical considerations remain active areas of research. Addressing these concerns requires advances in multimodal alignment, spatial reasoning, and scalable training strategies. As research progresses, VLA-powered generalist robots hold the potential to shift robotics from task-specific solutions toward systems that are versatile, adaptive, and aligned with human goals. This paradigm marks a significant step toward more autonomous, intelligent, and collaborative machines.

Keywords: *Vision-Language-Action (VLA) models, generalist robotics, multimodal learning, zero-shot generalization, action generation, natural language understanding, visual perception, scalable training, spatial reasoning, human-robot interaction.*

VIRTUAL QUEUE APPOINTMENT WEBSITE

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Abstract: Long queues and inefficient appointment systems often frustrate customers and create operational challenges for service providers. The Virtual Queue Appointment Web System addresses this issue by offering a digital solution that allows users to schedule appointments, track their position in line, and receive updates—all from any internet-enabled device. The platform minimizes waiting time, reduces crowding, and improves overall service flow. Organizations benefit from better resource allocation, reduced bottlenecks, and enhanced customer satisfaction, while users enjoy flexibility and convenience. Technically, the system is designed with scalability and reliability in mind. It incorporates responsive web design to ensure accessibility across devices, secure authentication to protect user data, and cloud-based infrastructure for seamless scalability and performance. The user-friendly interface ensures that both customers and administrators can interact with the system efficiently, while backend functionalities provide real-time synchronization and reporting capabilities. Built on scalable web technologies with secure authentication and real-time notifications, the system can be adapted across industries such as healthcare, banking, government services, and retail. This modern solution delivers efficiency, transparency, and a user-friendly experience for both service providers and customers.

Keywords— *Virtual Queue, Online Appointment, Web-Based Solution, Customer Experience, Queue Optimization, Digital Services, Efficiency*

TIME APPLICATIONS OF FLIPPER ZERO IN CYBERSECURITY AND HARDWARE INTERACTION

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Abstract: Flipper Zero is a compact, open-source multi-tool device designed for real-time interaction with a wide range of digital and wireless technologies. Built for penetration testers, developers, and tech enthusiasts, it offers powerful capabilities such as RFID/NFC reading and emulation, sub-1 GHz wireless communication, infrared signal control, and GPIO-based hardware interaction. This paper explores the real-time practical applications of Flipper Zero in everyday scenarios, including access control testing, IoT device diagnostics, wireless signal analysis, and remote device management. We demonstrate how Flipper Zero can be effectively used for quick field testing, security auditing, and troubleshooting in both professional and educational environments. Furthermore, the paper discusses the importance of ethical usage, data privacy, and legal boundaries when deploying such tools. By highlighting its versatility and portability development, and digital forensics.

Keywords: *Flipper Zero, Cybersecurity, RFID/NFC, Wireless Communication, IoT Security, Ethical Hacking, Digital Forensics.*

THE EMERGENCE THREAT OF PHISHING ATTACK AND THE DETECTION TECHNIQUES USING MACHINE LEARNING MODELS

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Abstract: Phishing email detection is a critical component of cybersecurity, aiming to identify and mitigate deceptive messages designed to steal sensitive information or compromise systems. This study explores advanced techniques for detecting phishing emails using a combination of natural language processing (NLP), machine learning (ML), and heuristic analysis. By analyzing linguistic patterns, metadata, and embedded URLs, the proposed model distinguishes phishing attempts from legitimate communications with high accuracy. The research evaluates various classification algorithms, including Random Forest, Support Vector Machines, and deep learning approaches such as LSTM and BERT. Experimental results demonstrate that contextual understanding and feature engineering significantly enhance detection performance.

Keywords: *Security alert, Unauthorized login, immediate action, account suspended*

TECHNOLOGICAL AND SOCIAL APPROACHES TO IMPROVING ORGAN DONATION RATES

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Abstract: Organ donation is a critical medical procedure that saves countless lives by transplanting healthy organs from donors to recipients in need. Despite its life-saving potential, the rate of organ donation remains insufficient due to lack of awareness, cultural barriers, and misconceptions. Promoting education and awareness about the importance of organ donation can significantly increase donor registration and improve transplant success rates. This abstract highlights the significance, challenges, and future directions in the field of organ donation, emphasizing the role of technology and community engagement in enhancing donation rates.

Keywords— Organ donation, Transplantation, Donor registration

SMART CYBER GUARDIAN: A REAL-TIME SYSTEM FOR MONITORING AND ALERTING PERSONAL DATA BREACHES

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Abstract— The Personal Data Leak Alert System is a proactive platform designed to safeguard individuals against data breaches, identity theft, and unauthorized exposure of personal information. With the rise of online accounts, sensitive data such as emails, phone numbers, and passwords are increasingly at risk. This system continuously monitors public breach databases and dark web sources, sending instant alerts when a user's information is found to be compromised. It offers a user-friendly dashboard displaying past alerts, risk levels, and exposure trends, along with practical guidance to secure accounts, including password updates, twofactor authentication, and integration with password managers. Leveraging AI-driven risk prediction, the platform estimates potential vulnerabilities based on user activity, while automated account security measures enhance protection. Features like multiaccount monitoring, multi-channel notifications, and trend analytics help users maintain a secure digital footprint, improve cybersecurity awareness, and proactively manage personal data in an increasingly connected digital environment

Keywords— Personal Data Protection, Dark Web Surveillance, Real-Time Alerts, Privacy Protection, Risk Prediction, DigitalFootprint Management

SECURE HEALTHCARE MONITORING SYSTEM USING EDGE COMPUTING AND BLOCKCHAIN TECHNOLOGY

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Abstract: The convergence of edge computing and blockchain technology presents a transformative approach to secure healthcare monitoring systems. This paper introduces a decentralized architecture that leverages edge nodes for real-time physiological data acquisition and processing, significantly reducing latency and network congestion. Blockchain integration ensures immutable data logging, access control, and auditability through smart contracts and consensus mechanisms. The system is designed to support continuous patient monitoring via wearable IoT sensors, with edge devices performing anomaly detection using lightweight machine learning models. To validate the proposed framework, simulations were conducted using EdgeSim and Hyperledger Fabric, evaluating metrics such as throughput, latency, energy consumption, and security breach resistance. Results demonstrate a 35% reduction in data transmission delay and a 42% improvement in system resilience compared to traditional cloud-based models.

Keywords: *Edge Computing, Blockchain, Healthcare Monitoring, IoT Sensors, Smart Contracts, Hyperledger Fabric, EdgeSim, Data Privacy, Real-Time Analytics, Decentralized Architecture, Anomaly Detection, Secure Data Transmission*

PRIVACY-PRESERVING MACHINE LEARNING IN MEDICAL

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Abstract: The health care industry generates vast amounts of sensitive patient data, which can be used to Improve diagnosis, treatment, and research through machine learning (ML) techniques. However, ensuring the privacy and security of medical data is a major challenge due to risks of data leakage, misuse, and regulatory constraints. Privacy-preserving machine learning (PPML) offers advanced methods to analyze and train models on medical data without exposing sensitive information. Techniques such as federated learning, homomorphic encryption, and differential privacy enable collaborative model development while safeguarding patient confidentiality. PPML not only enhances trust in AI-driven healthcare solutions but also complies with legal and ethical standards like HIPAA and GDPR. Despite its advantages, challenges such as computational overhead, system complexity, and scalability need to be addressed. This project highlights the importance of PPML in building secure, transparent, and reliable AI systems that enable innovation in medical research while protecting patient privacy.

Keywords: *Privacy Preservation, Machine Learning, Healthcare, Federated Learning, Differential Privacy, Homomorphic Encryption*

OFFLINE EMERGENCY CONTACT-WEB

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Abstract—In critical situations where internet connectivity is unavailable, accessing emergency contact information becomes a significant challenge. This project proposes an "Offline Emergency Contact — Web" system that enables users to retrieve and utilize essential contact details Without the need for an active internet connection. By integrating user-friendly interfaces and lightweight design, the solution is particularly suitable for use in remote areas, during natural disasters, or in low-connectivity zones. This innovation enhances personal safety and reliability in emergencies by bridging the gap between digital dependence and offline accessibility. This development focuses on interfaces that work on common devices, implementing robust message routing algorithms that adapt to changing network conditions, and ensuring the system can quickly activate and scale during actual emergencies. ultimately providing communities with an independent communication lifeline precisely when conventional systems are most likely to fail.

Keywords— Offline Web, Emergency Contact, Local Storage Safety, Accessibility, Disaster Management, PWA Responsive, Reliability, Web app , Preparedness.

MENTAL HEALTH MONITORING SYSTEM

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Abstract— In today’s digital era, technology plays a vital role in understanding and supporting human well-being. With the advancement of pervasive sensing technologies like smart phones, it has become possible to collect data continuously in a seamless and non-intrusive manner. Machine learning approaches have been utilized on this continuous sensor data to estimate various aspects of user context, including location, emotional state, physical activities, and more. In recent years, there has been increasing attention on employing these ubiquitous sensing tools in the field of mental health, enabling the automated and ongoing observation of psychological conditions such as stress, anxiety, depression, and bipolar disorder. This work reviews the latest studies on mental health monitoring systems (MHMS) that integrate sensor data with machine learning techniques. The survey emphasizes research related to specific psychological disorders and conditions, including depression, anxiety, stress, and bipolar disorder. Furthermore, we propose a structured classification framework to organize and analyze existing contributions, outlining the key stages involved in MHMS development. Finally, we highlight the current challenges in this domain and explore potential directions for future advancements.

Keywords— Mental health, machine learning, sensor data, smartphones, continuous monitoring..

HARNESSING ARTIFICIAL INTELLIGENCE FOR EMERGENCY RESPONSE IN DISASTER-AFFECTED REGIONS

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Abstract— Natural disasters such as earthquakes, floods, hurricanes, and wildfires often occur unexpectedly, causing widespread destruction and disruption to communities. Timely assessment and coordinated relief efforts are critical to minimize loss of life and property. Artificial Intelligence (AI) in disaster-affected areas has emerged as a valuable tool to support rapid response and recovery operations. By analysing realtime data from drones, satellites, IoT sensors, and social media, AI can identify damaged infrastructure, locate survivors, and prioritize the distribution of essential resources. Unlike predictive disaster systems, this approach emphasizes immediate post-disaster action, allowing authorities and rescue teams to respond effectively even with limited historical data. AI also enhances the safety of emergency personnel by identifying hazardous zones and optimizing rescue routes. With continuous advancements in machine learning, image recognition, and data processing, AI has the potential to transform disaster management, making humanitarian response faster, smarter, and more efficient.

Keywords— *Post-Disaster Response, Disaster affected areas, Rescue Operations, Real-Time Data Analysis, Drones and Satellite Imagery*

BREAST CANCER PREDICTION USING AI

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Abstract: This project focuses on breast cancer classification using machine learning techniques to aid in early detection and diagnosis. The dataset, containing patient records with diagnostic features, was pre processed through data cleaning, feature encoding, and normalization. Exploratory data analysis and visualization were performed to understand the distribution and relationships among features. Three supervised learning models—Logistic Regression, Decision Tree Classifier, and Support Vector Classifier (SVC)—were implemented and evaluated. Logistic Regression provided a baseline, while Decision Tree Classifier underwent hyper parameter tuning using GridSearchCV for optimized performance. The Support Vector Classifier was trained on scaled features to handle high-dimensional data effectively. Each model’s performance was assessed using accuracy scores, classification reports, and confusion matrices. The results highlight the comparative effectiveness of these algorithms in classifying malignant and benign cases, demonstrating the potential of machine learning in improving diagnostic accuracy in medical applications.

Keywords: *Breast cancer classification, Machine learning, Early detection ,Logistic Regression, Decision Tree, Classifier Support Vector, Classifier(SVC) ,Grid Search CV, Data pre-processing.*

COMPUTER SCIENCE: AI-DRIVEN OPTIMIZATION FOR SMART CITIES

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Abstract: The rapid urbanization and increasing complexity of modern cities demand innovative approaches to optimize resource management, enhance sustainability, and improve the quality of life for citizens. Artificial Intelligence (AI) offers transformative capabilities to enable smart city initiatives through data-driven decision making and real-time adaptive control. This paper explores AI-driven optimization techniques tailored for smart city applications, including traffic management, energy distribution, waste management, and public safety. By leveraging machine learning, deep learning, and reinforcement learning algorithms, the system dynamically analyzes vast sensor data and predicts urban patterns to optimize infrastructure utilization and reduce environmental impact. The integration of AI not only facilitates efficient city operations but also supports resilient urban planning and citizen-centric services. The study highlights key challenges, such as data privacy, scalability, and interoperability, and proposes future directions to maximize the potential of AI for sustainable and intelligent urban ecosystems.

Keywords: *AI, smart cities, optimization, traffic, energy, waste, safety, learning, privacy, sustainability.*

COMPUTER SCIENCE: FITNESS TRACKER

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Abstract: A fitness tracker is a wearable device designed to monitor and record an individual's physical activities and health-related parameters. It uses embedded sensors such as accelerometers, heart rate monitors, and GPS to capture raw data like movement pulse rate, and location. This data is processed into meaningful metrics including step count, distance traveled, calories burned, sleep patterns, and overall activity levels. The device synchronizes with mobile or cloud applications to provide real-time feedback, progress tracking, and personalized insights. By offering continuous monitoring and goal-oriented feedback, fitness trackers support users in improving their health, maintaining fitness routines, and adopting healthier lifestyles.

Keywords: *Wearable device, Health monitoring, Step count, Healthy lifestyle, Calories burned*

COMPREHENSION STUDY ON DETECTING CYBER SECURITY ATTACKS AND STRENGTHENING THE DIGITAL SECURITY USING ML.

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Abstract: In today's digitally connected world, cyberattacks have become increasingly sophisticated, posing significant threats to individuals, organizations, and national security. Traditional security measures often struggle to keep pace with evolving attack techniques. Machine learning (ML) offers a promising approach to enhance cyber defence by enabling systems to learn from data, detect anomalies, and respond to threats in real time. This paper explores the application of machine learning algorithms in identifying and mitigating cyberattacks, including intrusion detection, malware classification, phishing detection, and network traffic analysis. By analysing vast amounts of data, ML models can recognize patterns and predict malicious activities with greater accuracy than conventional methods. Furthermore, adaptive learning allows these models to evolve with emerging threats, providing a dynamic layer of security. The integration of ML into cybersecurity frameworks not only improves threat detection rates but also reduces false positives and response times. This research highlights the benefits, challenges, and future directions of using machine learning to strengthen digital security and create more resilient cyber infrastructures.

Keywords: Machine Learning, Cybersecurity, Intrusion Detection, Threat Intelligence, Anomaly Detection Network, Protection

AI-Driven Dual-Layer Cyber-Defense System (SSD kill switch)

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Abstract: The rapid emergence of Artificial Intelligence (AI) and Machine Learning (ML) has redefined modern cybersecurity by enabling systems that can predict, detect, and neutralize cyber threats in real time. This paper presents Project Ultron, a novel dual-layer security framework that integrates ML-based anomaly detection with a hardware-level SSD kill-switch to achieve unparalleled data protection. In the first layer, supervised and unsupervised ML algorithms monitor network traffic and system logs to identify patterns of distributed denial-of-service (DDoS) attacks, malware intrusions, and unauthorized access attempts. Upon detecting malicious activity, the second layer initiates an automated physical disconnection of the storage drive, ensuring that critical data remains secure even if software defenses are compromised. The proposed design demonstrates faster response times compared to traditional encryption-based security and provides an additional safeguard against zero-day exploits and ransomware. as a scalable and proactive defense strategy for enterprises, IoT networks, and data centers.

Keywords: AI, Machine Learning, Cybersecurity, Anomaly Detection, Intrusion Detection, SSD Kill Switch, Real-Time Threat Protection, Data Isolation.

AI BASED MENTAL HEALTH SUPPORT CHAT BOT

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Abstract-Mental health has become a critical concern in today's fast-paced and stressful world, especially among students and young adults. However, due to stigma, lack of awareness, or limited access to professional support, many individuals hesitate to seek help. This project proposes an AI-Based Mental Health Support Chat bot designed to provide users with an anonymous, accessible, and interactive platform for emotional support. The chat bot leverages Natural Language Processing (NLP) to analyze user input, detect stress or emotional states, and generate appropriate responses. It can provide motivational messages, relaxation techniques, self-care tips, and guidance for stress management. In cases where the detected concern is severe, the system can recommend professional help or provide helpline information. The prototype is developed using Python-based NLP frameworks and integrated into a user-friendly web/mobile interface. By combining technology with social impact, this project aims to create a supportive digital companion that encourages mental well-being and spreads awareness. The solution is scalable, language-adaptable, and can be extended for use in educational institutions, workplaces, and healthcare systems.

Keywords: *Artificial Intelligence, Chat bot, Mental Health, Natural Language Processing (NLP), Sentiment Analysis, Emotional Support, Stress Management, Human-Computer Interaction, Digital Health, Student Well-being.*

CLOUD SECURITY

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Abstract: Cloud Security is more important than ever as our lives and businesses move to online platforms. This project takes a hands-on approach to show how practical security steps like carefully setting who can access data, turning on multi-factor authentication, and using basic encryption can keep information safe in cloud environments. Using a popular cloud service, this demo will walk through simple but effective ways to protect against common problems such as unauthorized logins and accidental data leaks. The goal is to show that by using just a few built-in security tools, anyone from students to small businesses can make their cloud accounts much safer. This project hopes to make cloud security practical, easy to understand, and something everyone feels comfortable trying for themselves.

Keywords: *Data Protection, Multi-Factor Authentication (MFA), Access Control, Encryption*

A DECENTRALIZED BLOCKCHAIN FRAMEWORK FOR BLUE CARBON MRV WITH UAV-LIDAR AND MACHINE LEARNING

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Abstract:Blue carbon ecosystems, including mangroves and salt marshes, are recognized as vital natural resources for climate change mitigation due to their exceptional capacity for long-term carbon sequestration. Despite this importance, the absence of a decentralized, transparent, and verifiable Monitoring, Reporting, and Verification (MRV) mechanism limits the credibility of blue carbon initiatives and hinders their integration into carbon credit markets. This paper introduces BlueCarbonChain, a blockchain-powered MRV framework that leverages community validation, UAV-mounted LiDAR sensing, and artificial intelligence to ensure accuracy, accountability, and trust in carbon credit generation. The proposed system follows a three-stage verification process: (i) corporations submit plantation and restoration claims, which are validated through participatory review by local NGOs and coastal communities; (ii) high-resolution ecological data is collected using drone-based LiDAR and remote sensing technologies; and (iii) machine learning models estimate biomass and CO₂ sequestration, with verified outcomes immutably recorded on a blockchain network.

Keywords:Blue carbon ecosystems, Mangroves, Salt marshes, Climate change mitigation, Artificial intelligence, Machine learning, Digital MRV architecture.

AI-ENHANCED CREDENTIAL LEAK DETECTION AND ENCRYPTION FRAMEWORK FOR SECURE SOURCE CODE REPOSITORIES

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Abstract: An increasing dependence on open-source platforms and collaborative software development, developers frequently share and maintain source code through public repositories such as GitHub, GitLab, and Bit bucket. Although these platforms accelerate productivity and teamwork, they also introduce a critical security challenge—accidental credential exposure. Sensitive information such as API keys, private tokens, SSH credentials, and database passwords are often hardcoded within the source code or configuration files for convenience during testing and deployment. When such repositories are made public, these credentials become accessible to malicious actors, leading to unauthorized system access, data loss, and large-scale breaches. Studies show that millions of credentials are exposed annually due to insufficient repository security practices, making credential leakage one of the most prevalent yet preventable forms of cyber risk. Existing tools like GitLeaks, Truffle Hog, and Yelp Detect-Secrets employ static rule-based or entropy-based scanning techniques to detect exposed secrets.

Keywords: Credential leakage, AI-based detection, AES encryption, repository security, DevSecOps, VAPT, source code protection.

BLOCKCHAIN AND AI-ENABLED DIGITAL TWIN ARCHITECTURE WITH IOT INTEGRATION FOR CYBERSECURITY APPLICATIONS

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Abstract In today’s digital world, cybersecurity has become one of the biggest challenges due to the rapid growth of smart devices, networks, and connected systems. With the increasing use of the Internet of Things (IoT) in industries, healthcare, and homes, there is a higher risk of cyberattacks such as data theft, hacking, and unauthorized access. This helps to monitor system behavior, detect unusual patterns, and predict possible cyber threats before they happen. Blockchain provides a decentralized and tamper-proof record of all transactions. Every IoT device connected to the system has its own identity stored securely on the blockchain, making it difficult for attackers to change or fake information. Smart contracts are used to automatically enforce security rules, improving trust and reducing human error. The integration of these three technologies. Digital Twin, Blockchain, and AI creates a powerful cybersecurity solution. The system can detect and respond to threats in real time, ensure secure communication among IoT devices, and maintain data integrity across the entire network. A prototype was developed and tested in a simulated IoT environment to evaluate performance. 3

Keywords : Cybersecurity, Internet of Things (IoT), Digital Twin, Blockchain, Artificial Intelligence (AI), Machine Learning, Smart Contracts, Data Integrity, Threat Detection, Secure Communication.

DEPARTMENT OF ELECTRICAL AND
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AI-ASSISTED CIRCUIT DESIGN

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Abstract: The rapid growth of electronic systems has increased the demand for efficient, reliable, and innovative circuit designs. Traditional circuit design methods often involve time-consuming trial-and-error processes and require expert knowledge, making them less adaptable to complex modern requirements. Artificial Intelligence (AI) offers new possibilities in automating and optimizing circuit design by applying machine learning, deep learning, and evolutionary algorithms. AI-assisted circuit design enables automated schematic generation, optimal component selection, error detection, and performance prediction, significantly reducing design time and human error. This paper explores the application of AI techniques such as neural networks, reinforcement learning, and genetic algorithms in circuit design and optimization. The study highlights how AI-driven tools can accelerate innovation, enhance accuracy, and improve overall efficiency in developing circuits for power systems, communication devices, and electronic applications.

Keywords: Artificial Intelligence (AI), Circuit Design Automation, Machine Learning, Deep Learning, Neural Networks, Reinforcement Learning

AUTOMATED IRRIGATION SYSTEM USING WIRELESS SENSOR NETWORK WITH IOT

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Abstract: The rapid growth of agriculture demands efficient water management practices to ensure sustainable crop production and resource conservation. Traditional irrigation methods often lead to overuse of water, reduced crop yield, and increased operational costs. This paper presents an automated irrigation system that integrates a Wireless Sensor Network (WSN) with Internet of Things (IoT) technology to achieve intelligent water distribution. The system employs distributed soil moisture, temperature, and humidity sensors to collect real-time environmental data, which is transmitted wirelessly to a central controller. Through IoT connectivity, data is processed and monitored remotely via cloud platforms and mobile applications, enabling farmers to make informed decisions and automate irrigation schedules. The proposed framework not only reduces water wastage but also enhances crop productivity by delivering precise irrigation based on soil and crop requirements. This integration of WSN and IoT provides a scalable, cost-effective, and sustainable solution for smart agriculture, supporting the vision of modern precision farming and resource-efficient practices.

Keywords: Wireless Sensor Network (WSN), Internet of Things (IoT)

APPLICATION OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING TECHNIQUES TO IMPROVE THE CHIP DESIGN PROCESS

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Abstract— In congested urban cities, the effectiveness of public transport is an essential aspect of reducing traffic congestion and improving the day-to-day commuter experience. This paper presents a cutting-edge Bus Tracking System that is carefully planned to enable commuters by giving them real-time information on bus locations, availability, and predicted arrival and departure times. By harnessing the latest technologies, this revolutionary system provides a variety of benefits, most importantly passenger wait time reduction, route planning optimization, and overall improvement in the public transportation experience. By presenting an in-depth analysis of the importance of bus tracking technology and its ability to transform the mobility of cities, this study emphasizes its role as a driver for sustainable, convenient, and hassle-free transportation solutions based on the requirements of contemporary cities. Our model employs machine learning algorithms such as regression, Kalman filter algorithm, and support vector machines to assess the accuracy of bus arrival and departure and assist further in time-saving and demand-based management of buses. Google Maps API and Google Geolocation API can provide a real-time location of buses.

Keywords— *Chip, API.*

DEMYSTIFYING DEFECTS: FEDERATED LEARNING AND EXPLAINABLE AI FOR SEMICONDUCTOR FAULT DETECTION

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Abstract:Semiconductor production is vital for modern technology but involves complex processes where fault detection is critical for reliability and cost efficiency. Traditional machine learning requires centralized sensitive data, which stakeholders like OEMS, IDMs, and wafer foundries hesitate to share. This work introduces a Federated Learning (FL) and Explainable AI (XAI)- based fp reductions. The framework supports heterogeneous datasets and varied node capacities. Experiments on a public dataset achieved 98.78%test accuracy, proving the model's effectiveness in improving fault detection, enhancing semiconductor production reliability, and boosting efficiency.

Keywords— *Federated Learning (FL),Explainable AI (XAI)*

EMERGENCE OF AI AND ML TRANSFORMING THE FUTURE

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Abstract: The Queen is dead, long live the King Perhaps one could suggest to focus on the new emerging world of Artificial Intelligence (A.I.) and its little sidekick Machine Learning (ML) for short as some potential winners in epoch-changing technological revolutions that has actually swept across a phase or so over number of recent years reshaping what man means updating machines, feasting upon information and creating fresh ideas. AI & ML from first principle to applied turning them into a pan industry (eg health, finance, education, travel transport and manufacturing) in-the-real-world commercials. These are the breakthroughs that have empowered machines to learn from example, find information and process base-level optimization — and they open up some incredible opportunities toward efficiency at scale, automation and innovation. In this paper we study the development to AI and ML starting with old symbolic methods going into last year’s deep learning and generative models. It has also provided applications like, medical diagnosis, fraud analysis detection, self-driving car and smart learning etc. Finally, ethical and social implications like algorithmic bias, data privacy and transparency(agorni) [36-38] for ethics in AI governance are addressed in this paper. Third, make available status-of-play view to what tomorrow holds for us – explainable AI, federated learning, AI meets other emergent tech like quantum and edge. These developments validate that AI and ML will play a huge role in making the world smarter, connected.

Keywords: AI&ML, Ethical AI , Sustainable AI

GRAPH NEURAL NETWORKS PREDICT VOLTAGES ON IEEE-13 BUS AND118 BUS SYSTEM

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Abstract: This paper proposes a novel approach using Graph Neural Networks (GNNs) to solve the AC Power Flow problem in power grids. AC OPF is essential for minimizing generation costs while meeting the operational constraints of the grid. Traditional solvers struggle with scalability, especially in large systems with renewable energy sources. Our approach models the power grid as a graph, where buses are nodes and transmission lines are edges. We explore different GNN architectures, including GCN, GAT, SAGE Conv, and Graph Conv to predict AC power flow solutions efficiently. Our experiments on IEEE test systems show that GNNs can accurately predict power flow solutions and scale to larger systems, outperforming traditional solvers in terms of computation time. This work highlights the potential of GNNs for real-time power grid management, with future plans to apply the model to even larger grid systems.

Keywords: Graph Neural Networks (GNNs), GNN Architectures

DRAFT STANDARD FOR POWER LINE CARRIER LINE TUNNING EQUIPMENT(30-500Khz) ASSOCIATED WITH POWER TRANSMISSION LINES

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Abstract: The image displays the title and key details of an IEEE Draft Standard related to power-line communication. The primary text reads: "IEEE Draft Standard for Power- Line Carrier Line-Tuning Equipment (30-500 kHz) Associated with Power Transmission Lines." This indicates the document's scope, focusing on the technical specifications for equipment used in power-line carrier (PLC) systems, specifically for line-tuning, operating within the 30-500 kHz frequency range, and designed for integration with power transmission lines. Below the main title, the document identifier and publication date are provided: "IEEE PC93.4/D14, September 2011." This specifies the particular draft version (D14) of the PC93.4 standard and its release month and year. In essence, the image presents a clear and concise reference to a technical standard addressing a specialized area within electrical engineering and telecommunications, particularly the infrastructure and operational parameters for power-line carrier technology as applied to power transmission networks.

Keywords: Power Transmission Lines, Telecommunications, Power Transmission Lines

EXPLANABLE AI BASED IMPROVED INTRUSION DETECTION SYSTEM IN WIRELESS SENSOR NETWORK

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Abstract: Wireless Sensor Networks (WSNs) are increasingly deployed in critical applications such as environmental monitoring, military surveillance, and industrial automation. However, their resource-constrained nature and open communication environment make them vulnerable to various security threats. Traditional Intrusion Detection Systems (IDS) often act as black boxes, offering little insight into the reasoning behind their decisions, which poses a challenge in high-stakes or real-time scenarios. This paper proposes an improved Intrusion Detection System for WSNs that integrates Explainable Artificial Intelligence (XAI) techniques to enhance both detection accuracy and interpretability. The system employs a lightweight machine learning model optimized for energy efficiency, combined with XAI methods such as SHAP (Shapley Additive explanations) and LIME (Local Interpretable Model- Agnostic Explanations), to provide human-understandable justifications for detection outcomes.

.Keywords: Wireless Sensor Networks (WSNs); Intrusion Detection Systems (IDS); Explainable Artificial Intelligence (XAI); Local Interpretable Model- Agnostic Explanations (LIME).

FAULT DETECTION IN ELECTRICAL MACHINES USING MACHINE LEARNING

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Abstract: Fault detection is essential to system levels of safety, system levels of reliability, and system efficiency. Conventional fault detection methodologies struggle with processing high-dimensional data and cannot make use of subtle or nonlinear relationships. This work develops a machine learning-aided intelligent fault detection method by utilizing advanced algorithms to process system data and provide out-of-box anomalies to forecast possible failures. Proposed methodology utilizes supervised learning models and unsupervised learning models to ensure precise fault classification with early fault detection. Experimental evaluation proves enhanced detection precision, fewer false alarm triggers, and quick responding time compared to traditional methodologies. The method not only optimizes system operating levels of reliability but also provides predictive maintenance for optimal downtime minimization and attainment of better system levels of performance.

Keywords: Fault Detection, Machine Learning, Predictive Maintenance, Anomaly Detection.

GENERATIVE AI FOR DESIGN

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Abstract: Generative AI for design is transforming the way creative professionals approach problem solving, innovation, and production. It refers to the use of artificial intelligence models that can generate new ideas, visuals, structures, or solutions by learning from large datasets of existing designs. Unlike traditional tools that require direct step-by-step instructions, generative AI can autonomously propose alternatives, adapt to user preferences, and explore possibilities beyond human imagination. Designers in fields such as architecture, fashion, graphic design, and product development are increasingly adopting this technology to speed up workflows, enhance creativity, and discover unique forms or patterns that would be difficult to conceive manually. The technology enables rapid prototyping by simulating and evaluating numerous variations based on given parameters, saving time and resources. It also helps in personalization, ensuring that designs are tailored to individual needs or contexts. However, challenges such as ethical concerns, authorship, and over-reliance on algorithms remain important considerations. Overall, generative AI serves as a powerful partner to human creativity, broadening the potential of design while reshaping roles, methods, and outcomes in the creative process.

Keywords: AI, Designers, Finite Element Analysis, Generative Algorithm, Design Constraints

INTELLIGENT SOLAR TRACKING SYSTEM

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Abstract: The rapid depletion of conventional energy resources has created an urgent need for efficient renewable energy solutions. Solar energy, being abundant and eco-friendly, is one of the most promising alternatives. However, the efficiency of fixed solar panels is limited as they cannot follow the sun’s movement throughout the day. This paper presents an Intelligent Solar Tracking System designed to maximize solar energy harvesting by automatically adjusting the orientation of solar panels in real time. The system employs light sensors (LDRs) and a microcontroller to detect the sun’s position and drive motors for panel alignment. Advanced versions can integrate IoT and AI-based algorithms to enhance tracking accuracy and adapt to weather conditions. Compared to static solar panels, intelligent tracking improves power output by 20–40%, making it highly beneficial for residential, commercial, and industrial applications. This innovation not only enhances energy efficiency but also supports sustainable development by providing a cost-effective and reliable source of clean energy.

Keywords:Light sensors, Solar Tracking System

INTERFERENCE MITIGATION AND RADAR PRIVACY PROTECTION UNDER MIMO SHARED SPECTRUM SCENARIOS

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Abstract: The growing demand for spectrum resources has led to increased interest in spectrum sharing between radar and communication systems, particularly in the context of Multiple-Input Multiple-Output (MIMO) architectures. While spectrum sharing enhances spectral efficiency, it also introduces critical challenges, including mutual interference and potential leakage of sensitive radar information to communication systems. This paper investigates joint strategies for interference mitigation and radar privacy protection in MIMO shared spectrum environments. We first model the coexistence of a MIMO radar and a MIMO communication system, accounting for spatial domain characteristics and channel uncertainty. Next, we propose a novel interference-aware beamforming algorithm that minimizes cross- system interference while preserving radar performance. To address privacy concerns, we introduce a low- rank signal obfuscation technique that masks radar parameters from potential eavesdroppers without significantly degrading radar detection capabilities. Simulation results demonstrate that the proposed approach effectively suppresses mutual interference and safeguards radar operational privacy, making it viable for real-world deployment in congested spectrum environments.

Keywords:Radar,Spectrum

IOT BASED SMART GARBAGE MONITORING SYSTEM

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Abstract:The IoT-based Smart Garbage Monitoring System is an innovative solution designed to enhance waste management efficiency by leveraging modern technologies. This system uses an ultrasonic sensor to measure the garbage level in bins, a Node MCU microcontroller to process the data, and Blynk Cloud for real-time monitoring. The system notifies municipal authorities when the bin reaches its threshold, ensuring timely waste disposal. This approach reduces manual monitoring, prevents overflow, and promotes a cleaner environment through optimized waste collection.

Keywords:*IoT, MCU, Smart Garbage Monitoring System, Blynk Cloud*

INTRODUCTION OF AI & ML HISTORY EVALUATION AND CURRENT TRENDS

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Abstract:Artificial Intelligence (AI) and Machine Learning (ML) have become revolutionary technologies that are revolutionizing the future of industries, communities, and everyday life. AI is the general term for creating machines with human-like intelligence, whereas ML is a branch of AI that allows systems to learn and get better without being programmed. The paper offers a brief history of the evolution, development, and present trends of AI and ML. It starts with the initial roots in the 1940s and 1950s, tracing major landmarks like the origins of symbolic AI, the boom and bust of expert systems, the transition to data-driven machine learning, and the advances in deep learning. The progression of AI and ML is illuminated from rule-based reasoning to contemporary generative AI, which can generate human-like text, images, and multimedia data. The latest trends such as generative AI, edge AI, explainable AI, and applications in healthcare, finance, and autonomous systems are covered with a focus on their social implications and ethical concerns. The paper ends by emphasizing that AI and ML are still developing rapidly, bringing unprecedented potential but requiring transparent and responsible deployment.

Keywords:*Machine Learning (ML), Artificial Intelligence (AI)*

IOT-BASED AIR POLLUTION MONITORING SYSTEM

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Abstract: The IoT-based Air Pollution Monitoring System is designed to track and analyze air quality in real-time. It uses sensors to detect harmful gases like CO, CO₂, SO₂, and particulate matter (PM2.5/PM10). The collected data is transmitted through IoT modules to cloud storage or a central server. Users can access this data remotely via mobile applications or web dashboards. The system provides alerts when pollution levels cross safe thresholds. It helps in identifying pollution sources and supports government policies for pollution control. This solution offers a cost-effective, scalable, and efficient way to ensure healthier environments.

Keywords: *Air Pollution Monitoring System, Web dashboards*

ML AND FAIL OR REQUIRE MAINTANCE AND ENABLING PRODUCTIVE MAINTANCE

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Abstract: Machine Learning (ML) is being used more and more in businesses to tackle the problem of system failure and maintenance management. Conventional maintenance strategies like reactive or preventive are usually associated with random breakdowns, excessive expenditure, and wastage of resources. ML can support predictive and productive maintenance through the examination of large amounts of real-time as well as historical data to identify anomalies, failure prediction, and estimation of remaining useful life of equipment. This intelligent method reduces downtime, optimizes maintenance cycles, improves safety, and increase asset lifespan and reduce total operational expenditure. While doing so, ML systems also have issues like dependency on data, high initial cost of setup, model drift, and problems in integration with legacy systems. Despite these shortcomings, the fact that ML can learn and adapt continuously makes it a strong solution for contemporary industries. In summary, Machine Learning not only offers failure detection and maintenance optimization but also turns classical maintenance into a proactive, efficient, and sustainable process eventually enhancing reliability, productivity, and decision.

Keywords: *Machine Learning(ML), Maintenance Management, System Failure, Reactive Maintenance.*

SOLAR ENERGY MEETS ARTIFICIAL INTELLIGENCE A POWERFUL COMBINATION FOR A SUSTAINABLE TOMORROW

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Abstract: The future of solar energy hinges on integrating advanced technology. Driven by the need to combat high fossil fuel costs and climate change, solar energy is crucial despite the challenge of its weather-dependent nature. To overcome this, soft computing, machine learning, and optimization techniques are being adopted. The critical step is to seamlessly combine these methods with emerging digital tools like the Internet of Things (IoT), Big Data, and cloud computing. This synergy enables the creation of intelligent, linked solar ecosystems capable of real-time optimization of energy flow, dramatically improving efficiency and resilience. This transformation also creates an urgent demand for experts in cybersecurity to protect these sophisticated new systems. Option 2: Emphasizing Integration and Benefits (More concise) Facing volatile fossil fuel prices and climate mandates, solar energy must overcome its inherent variability. Machine learning and soft computing offer solutions, but their full potential is unlocked only through integration with IoT, Big Data, and the cloud.

Keywords: Internet of Things (IoT), Machine Learning, Optimization Techniques

SMART ENERGY OPTIMIZER USING IOT AND MACHINE LEARNING FOR SUSTAINABLE POWER MANAGEMENT

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Abstract: The growing global demand for electricity, there is an immediate need to adopt smarter and more efficient modes of energy utilization. This paper provides the design and development of an IoT-based smart energy optimizer coupled with machine learning (ML) in order to encourage energy efficiency, minimize waste, and aid sustainability initiatives. The system proposed employs a network of sensors and microcontrollers for real-time monitoring of important electrical parameters like voltage, current, power utilization, and load behavior. These streams of real-time data are processed through ML algorithms that can forecast peak energy demand, identify anomalies (like power leaks or unusual usage), and make intelligent recommendations for energy usage. One of the main aspects of this system is that it can control electrical loads automatically. As an example, it can turn between traditional grid power and such renewable resources as solar power, as and when available and needed, to achieve the optimal utilization of resources. This interaction not only minimizes energy expenditure, but also lessens carbon footprints considerably. The system can be accessed by users via a simple web and mobile dashboard, which offers them a window into their energy usage.

Keywords: Machine Learning (ML), ML Algorithms, Renewable Resources.

SMART MONITORING SYSTEM OF ENERGY METER USING IOT

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Abstract: The Smart Monitoring System for Energy Meters using IoT demonstrates an effective and scalable solution for real-time energy management. By leveraging IoT technology, the system provides accurate, timely, and remote access to electricity consumption data, thereby eliminating the inefficiencies of traditional manual meter reading. It empowers consumers to track their energy usage patterns, manage consumption, and potentially reduce electricity bills. The system also opens pathways for energy providers to implement demand-based pricing, detect energy theft, and automate billing. Future improvements may include integration with mobile payments, AI-based consumption predictions, and compatibility with renewable energy sources. Overall, the system contributes significantly toward smarter homes, efficient energy use, and sustainable urban development

Keywords: IoT (Internet of Things), Smart Energy Meter, Energy Monitoring, Real-time Monitoring, Energy Management, Smart Grid.

SMART HOME AUTOMATION WITH AI OPPORTUNITIES AND CHALLENGES

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Abstract: Smart home automation is fast changing with the incorporation of Artificial Intelligence (AI) which holds considerable promise to revolutionize daily living. Automation using AI makes homes more responsive, efficient, and adaptable to user demands by understanding patterns of behavior and taking informed decisions. By integrating these devices and systems in the home—such as lighting, security, heating, and entertainment—households can be made to work harmoniously together, tailoring experiences and improving overall quality of life. The potential in AI-based smart home automation is wide-ranging. AI has the potential to enhance energy efficiency substantially by learning people’s behaviors and optimizing the usage of appliances, cutting costs as well as environmental footprint. AI-enhanced security systems can offer sophisticated monitoring, facial detection, and predictive notifications, making homes safer. In addition, the employment of natural language processing and voice assistants has rendered human– machine interaction more intuitive, enabling users to switch devices on and off with ease. AI further facilitates healthcare applications in smart homes, including tracking elderly residents, identifying abnormal health trends, and supporting daily activity, thus ensuring independent living. In spite of the potential, challenges still exist for the mass use of AI-based smart home systems. Issues of data privacy and cybersecurity are still a priority, as intelligent devices continually gather and send personal user data. The absence of a standardization and interoperability protocol for devices from various vendors also poses a limitation, tending to result in disjointed systems.

Keywords: Home Automation, Energy Efficiency, Home Security

SMART IOT BASED WEATHER REPORTING SYSTEM

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Abstract: An Integrated IoT-Based System for Weather Reporting and Predictive Analysis The limitations of traditional, centralized weather stations often lead to limited data and inaccurate local forecasts. This creates challenges for fields like precision agriculture, urban planning, and disaster preparedness. This paper discusses the development and deployment of an Internet of Things (IoT)-based Weather Reporting System designed to provide hyper-local, real-time environmental information. Our proposed system uses a scalable network of low-cost, energy-efficient sensor nodes placed across a specific area. Each node includes a microcontroller (like an ESP32) and various sensors to measure key parameters: air temperature, relative humidity, atmospheric pressure, wind speed, direction, and rainfall intensity. The microcontroller processes this raw data and uses a wireless communication module (Wi-Fi or GSM/LoRa) to send data packets securely and frequently to a cloud computing platform (such as AWS IoT or a dedicated service like Thing Speak). This cloud setup manages data collection, storage, and processing. Importantly, the platform includes an alert feature that informs users via SMS or email when specific thresholds are crossed (like a sudden pressure drop indicating a storm or critical humidity levels for crop management). Additionally, by gathering high-frequency, detailed data over time, the system builds a solid dataset that can be input into Machine Learning (ML) models for shortterm predictive analysis. This enables more accurate, local, and timely weather forecasting than is typically available from regional public services.

Keywords: weather reporting and prediction, hyper-local information, IoT.

IMPROVING EV CHARGING SYSTEM RELIABILITY BY DETECTING ABORTING CAUSESUSINGALGORITMICTECHNIQUES

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Abstract: Quick uptake of electric vehicles (EVs) requires charging systems that are faster, safer, more efficient, and more convenient. Existing charge systems have limitations, including long charging periods, overloading the grid at peak demand, and incompatibility of standards. This research examines an approach to enhance electric vehicle charging systems through enhanced power electronics, intelligent control techniques, incorporation of renewable energy sources, and intuitive interfaces. Technologies such as silicon carbide components, dynamic load management, vehicle-to-grid (V2G) functionality, and local energy storage are noted as key tools with high efficiency. Collectively, they seek to reduce charging time, increase battery longevity, make the grid more stable, and provide a more convenient and sustainable charging experience.

Keywords: Dual active bridge, Bidirectional power transfer, Two active bridges, Core loss, Copper loss.

AI-DRIVEN ANOMALY DETECTION IN INDUSTRIAL MACHINES

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Abstract:Industrial machinery plays a vital role in manufacturing, energy, and other sectors, where unplanned failures can lead to significant downtime, financial losses, and safety risks. Traditional maintenance strategies, such as reactive and preventive maintenance, are no longer sufficient to meet modern demands for efficiency and reliability. This paper focuses on AI-driven anomaly detection as a transformative approach to monitoring the health of industrial machines. By leveraging machine learning algorithms and predictive analytics implemented in MATLAB, industries can process sensor data, identify unusual patterns, and predict faults at an early stage. The output of the MATLAB system includes visualizations of machine health status, anomaly detection plots, and classification results, which help in preventing breakdowns before they escalate.

Keywords:Anomaly Detection, Artificial Intelligence (AI), Industrial Machines, Predictive Maintenance, MATLAB, Machine Learning, Fault Detection.

ADVANCE IN WIRELESS SENSOR NETWORK DESIGN AND APPLICATIONS

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Abstract:Wireless Sensor Networks (WSNs) have emerged as a transformative technology for the integration of sensing, computation, and communication for a wide range of applications. Recent advances in the design and deployment of WSNs are driven by the growing need for intelligent, scalable, and energy-efficient solutions across domains such as environmental monitoring, healthcare, industrial automation, smart cities, and defense. Modern WSN architectures incorporate low-power microcontrollers, energy harvesting techniques, and adaptive communication protocols to overcome traditional challenges of limited power, bandwidth constraints, and node failures. The evolution of routing algorithms, data aggregation methods, and fault-tolerant mechanisms has significantly enhanced the reliability, scalability, and lifetime of sensor networks. Integration with emerging technologies such as the Internet of Things (IoT), cloud computing, edge computing, and machine learning has expanded the functional scope of WSNs. Intelligent data processing at the edge reduces latency and enhances decision making, while machine learning-driven optimization improves routing efficiency, anomaly detection, and predictive maintenance. Furthermore, advances in security protocols and lightweight cryptographic schemes address concerns of data integrity, privacy, and resilience against cyber threats. Applications of WSNs now extend beyond traditional environmental sensing to real-time health monitoring systems, precision agriculture, structural health monitoring, disaster management, and military surveillance.

Keywords:Wireless sensor Networks, IoT

AI-DRIVEN PREDICTIVE ANALYTICS FOR OPTIMIZING WASTE COLLECTION LOGISTICS IN SMART CITIES

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Abstract: Civic bodies collect the waste in a traditional way such as in the pre- designated location and routes. This leads to ineffective process completion. Hence novel system utilizing AI and machine learning techniques have been developed to solve the problems faced in waste collection process. The suggested frame works synchronizes real time data with IOT enable desk collection bins through the proposed system. Thus, this establishes the most efficient way of work collection through AI driven and data centric approach.

Keywords:Waste Collection, Intelligent Control

AI-POWERED INNOVATIONS IN MICROPLASTIC DETECTION: FROM ML-ENHANCED SPECTROSCOPY TO INTELLIGENT SENSOR NETWORKS

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Abstract:Microplastics (MPs, <5 mm) and nano plastics (NPs, <1 µm) are synthetic particles that have become widespread pollutants in water, land, air, and living organisms. Their varied physical and chemical properties, including different types of polymers, shapes, and surface characteristics, make them difficult to detect, especially in complex mixtures at levels relevant to the environment. This review looks at recent progress in the detection, identification, and measurement of MPs and NPs. It highlights advancements in analytical techniques, such as vibrational spectroscopy (µ-FTIR, µ-Raman, SRS), thermal decomposition-mass spectrometry (Py-GC-MS, TED-GC-MS, TOF-SIMS), and new electrochemical sensing methods (EIS, PEC, and voltametric sensors). We focus on electrochemical platforms that use polymer–electrode interactions, which enable sensitive, label-free, and real-time detection. These methods show potential for miniaturization and use in the field. The review also examines how artificial intelligence (AI) and machine learning (ML) are being used with complex spectral and electrochemical data to improve classification accuracy, shorten analysis time, and aid automation. Recent innovations, like smartphone-enabled sensors, microfluidic systems, and point-of-care devices, are noted for their potential in detecting MPs and NPs in environmental and biological samples.

Keywords:Microplastics, Nano plastics, Vibrational Spectroscopy, Mass Spectrometry, Electrochemical Sensors, Point-of-Care Detection, AI-Driven Analysis

ANALYSIS AND DESIGN OF MODERN HOUSE USING ARTIFICIAL INTELLIGENCE

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Abstract: Artificial Intelligence is increasingly influencing the way architects and engineer approach the design of modern homes. beyond its technical capabilities AI offers new possibilities for creating buildings that are more efficient, sustainable, and responsive to human needs. this paper examines how AI can be applied in the early design stages structural planning and performance assessment of contemporary residential house. The approach combines generative design methods, Building Information Modeling and energy analysis supported by machine learning. The study shows that AI can simplify repetitive design tasks help achieve better space planning, and support decisions that lower construction costs. The results suggest that AI based design solutions have the potential to cut energy use by around 25% while also improving comfort, usability, and overall structural performance slightly narrative style which feels more human authored.

Keywords: Artificial Intelligence, Machine Learning

DESIGN OF AN ENERGY-EFICIENT LIGHTINING SYSTEM FOR PUBLIC SPACES

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Abstract:Public spaces, including streets, public parks, transport terminals, and community areas, require Reliable and well-distributed lighting to ensure safety, accessibility, and comfort for all users during Evening and night hours. Traditional lighting systems, such as high-pressure sodium or fluorescent Lamps, are not only energy-intensive but also lead to significant operational costs and increased Carbon emissions. With the growing emphasis on sustainability and smart urban planning, there is a Pressing need to design energy-efficient lighting systems that address these challenges effectively. This paper presents the conceptualization and design of an energy-efficient lighting system Specifically tailored for public spaces. The proposed framework integrates advanced light-emitting Diode (LED) technologies, motion and ambient light sensors, and adaptive control mechanisms to Dynamically regulate illumination levels based on real-time environmental conditions, occupancy Patterns, and human activity. Such a system can automatically dim or brighten the lights as needed, thereby optimizing energy usage without compromising safety or visual comfort.

Keywords: Sustainable Urban Lighting, LED Lighting Technology, Public Space Illumination, Energy-Efficient Lighting.

ARTIFICIAL INTELLIGENCE-DRIVEN FAULT DETECTION IN ELECTRICAL POWER SYSTEMS

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Abstract:

The electrical power system is the backbone of modern society, supplying energy to industries, households, and critical infrastructures. With the rapid growth of demand, integration of renewable energy, and expansion of distribution networks, the grid has become increasingly complex. This complexity also makes it more vulnerable to disturbances and faults, which, if not detected quickly, can cause outages, equipment damage, and financial losses. Traditionally, fault detection in distribution networks has relied on fixed threshold-based methods. While these methods are simple and widely used, they often fail to adapt in dynamic environments where load variations, harmonics, and renewable energy fluctuations are common. As a result, many faults either go unnoticed or are incorrectly classified, leading to inefficiencies in protection systems. To overcome these challenges, this work proposes an artificial intelligence (AI)-based fault detection framework designed specifically for medium-voltage distribution networks. By training the model with fault and non-fault datasets, the system learns to identify subtle patterns that traditional methods miss. Unlike rigid threshold schemes, the CNN model adapts to changing grid conditions, making it suitable for real-time applications.

Keywords: Fault Detection, Intelligent Control

DEVELOPMENT OF AN IOT-BASED ENERGY MANAGEMENT SYSTEM FOR SMART BUILDINGS

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Abstract: The increasing demand for energy in urban areas has highlighted the importance of efficient energy utilization in smart buildings. The development of an IoT-based energy management system offers a promising solution to monitor, control, and optimize energy consumption in real time. By integrating IoT-enabled sensors, smart meters, and cloud-based platforms, the system enables continuous data collection on electricity usage, environmental conditions, and occupant behavior. This data is analyzed to provide actionable insights, automate load control, and ensure efficient operation of appliances, lighting, and HVAC systems. The proposed system enhances energy efficiency, reduces operational costs, and contributes to sustainability by minimizing wastage and integrating renewable energy sources. Furthermore, remote monitoring and intelligent decision-making capabilities make the system scalable and adaptable for diverse building infrastructures. The research demonstrates how IoT-based energy management can play a vital role in shaping the future of sustainable smart buildings.

Keywords: Smart Building, IoT

ELECTRIC VEHICLES: A SUSTAINABLE TRANSPORTATION SOLUTION

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Abstract: Electric Vehicles (EVs) are emerging as a promising solution for sustainable transportation. They reduce dependence on fossil fuels by utilizing electricity as a cleaner energy source. EVs contribute significantly to lowering greenhouse gas emissions and air pollution. With advancements in battery technology, their driving range and efficiency are improving. They support renewable energy integration through smart charging and energy storage. The lower maintenance and operating costs make EVs economically attractive. Government policies and incentives further accelerate their adoption worldwide. However, challenges like charging infrastructure and battery disposal remain. Continued research and innovation are essential to overcome these barriers. Overall, EVs play a vital role in achieving a greener and more sustainable future.

Keywords : Electric Vehicle

EMERGING TECHNOLOGIES IN ELECTRICAL CIRCUITS AND SYSTEMS

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Abstract: In the study of electrical circuits and systems is becoming the important technology. This has created the need for smarter and more reliable designs. The main aim of this paper is, some of the new technologies that are starting to change the way of circuits. A review is made on areas such as wide band gap semiconductors, nanomaterials, internet of Things (IoT), and artificial intelligence applications in electrical systems. The discussions highlight the role of power electronics in renewable energy and smart grid development system. the emerging technologies are not only improving present systems that also preparing the path of innovation.

Keywords: Electrical Circuits, Emerging Technologies, IoT, Artificial Intelligence, Power Electronics, Wide band gap semiconductors.

GREY WATER MANAGEMENT AND REUSE WETLAND MANAGEMENT WATER CONSERVATION

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Abstract: Greywater, comprising domestic wastewater excluding toilet discharge, presents a valuable yet underutilized resource for augmenting water supply, especially in water-scarce regions. As freshwater resources face increasing pressure due to population growth, climate change, and urban expansion, sustainable water management strategies become critical. Greywater reuse, integrated with wetland-based treatment systems, offers a promising solution to enhance water conservation, reduce environmental pollution, and support agricultural and landscape irrigation. This paper explores the potential of greywater management and reuse within the framework of wetland and water resources management. Emphasis is placed on the role of constructed wetlands in decentralized treatment systems, the environmental and health implications of greywater reuse, treatment technologies, and policy frameworks guiding its implementation. Case studies from developing and developed countries highlight the practical applications, challenges, and opportunities in scaling greywater reuse. The findings underscore the need for integrated planning, community engagement, and robust regulatory support to promote safe and effective greywater management as a pillar of sustainable water resource development

Keywords: Wastewater recycling, Wetland management, Greywater reuse.

INTEGRATED PLATFORM FOR CROWDSOURCED OCEAN HAZARD REPORTING AND SOCIAL MEDIA ANALYTICS

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Abstract: Marine risks like oil spills, toxic algal blooms, and severe weather conditions are great threats to Ecosystems, coastal communities, and oceanic activities. Conventional hazard monitoring is Dependent upon official government agencies, satellite imagery, and expert sensors that are subject to delays and poor coverage. This paper introduces a holistic platform that utilizes crowdsourced Reporting and social media analytics to enhance the accuracy and timeliness of ocean hazard Monitoring. The system under consideration is a combination of mobile apps for citizen reporting, AI-based social media mining through natural language processing.

Keywords: Natural Language Processing (NLP), Ocean Hazard Monitoring, Harmful Algal blooms, Disaster Response.

SMART EDUCATION WITH AI-POWERED ROBOTS

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Abstract: The incorporation of artificial intelligence (AI) in educational robotics has offered new possibilities to improve teaching and learning practices. The contribution is intelligent teaching resources based on robots designed for students to get more involved in an interactive and personalized way of study as well to interference different aspects of science. The proposed approach utilizes AI enabling technologies, e.g., natural language processing, machine learning and adaptive feedback systems to have robots act as interactive teaching assistants. These robots are expected to provide subject specific content and also personalise the content by understanding cognitive levels, learning styles of individual learners as well as their progress. The educational materials include hands-on lesson modules, virtual problem-solving activities, and real-time assessment tools to help both teachers and students in various learning environments. Through its integration of robotics and AI-guided pedagogies, it connects learners to creativity, critical thinking, and collaboration— all while addressing constraints such as teacher capacity and student differentiation.

Keywords: Educational Robots, Robot-based learning

SMART GRID FAULT DETECTION AND ISOLATION

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Abstract: The modern electric power grid is evolving into a Smart Grid through the integration of advanced communication, sensing, and automation technologies. One of the critical challenges in this intelligent infrastructure is the prompt and accurate detection and isolation of faults to ensure system reliability, minimize downtime, and prevent cascading failures. This paper explores advanced methods for Fault Detection and Isolation (FDI) in smart grids, focusing on the synergy of traditional protection schemes with modern approaches such as phasor measurement units (PMUs), artificial intelligence (AI), and Internet of Things (IoT)-enabled devices. Various types of faults and their impact on grid stability are analyzed, along with real-time detection techniques using signal processing and machine learning algorithms. The study also addresses the challenges of data latency, false positives, and cybersecurity threats. By leveraging smart grid capabilities, the proposed FDI strategies enable faster response, improved fault localization, and self-healing mechanisms, ultimately enhancing the resilience and efficiency of future power systems.

Keywords: Anomaly Detection, Artificial Intelligence (AI), Industrial Machines

SMART POWER AND SUSTAINABLE ENERGY USING AI

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Abstract: Smart power is an intelligent way of electrical grid. which uses digital communication and automation to control and monitor energy flow in real time, integrating renewable source and it enhance efficiency the approach paves the way for smart and sustainable energy system for future the growing global demand for energy calls for innovative solutions which balance sustainability reliability and efficient. Smart power system is the efficient system which integrate the advanced technologies such as IOT, AI and renewable energy. That optimize, generation, distribution and consumption.

Keywords: IOT, Electric grid, AI

SMART POWER AND EMBEDDED SYSTEMS USING AI

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Abstract: Smart power and embedded systems using AI are transforming various industries by enabling devices to think, learn, and act autonomously. The integration of smart power technologies with embedded systems is reshaping modern energy management and control applications. A smart power and embedded system combine advanced power electronics, intelligent control strategies, and embedded computing platforms to achieve high efficiency, reliability, and automation in energy conversion and utilization. Such systems are widely employed in renewable energy integration, smart grids, electric vehicles, and industrial automation, where real-time monitoring and decision-making are critical. Embedded controllers enable adaptive operation, fault detection, and communication with IoT-based platforms, ensuring optimized energy distribution and reduced power losses. By leveraging microcontrollers, sensors, and communication protocols, smart power and embedded systems provide scalable, cost-effective, and sustainable solutions for next-generation energy and electronic applications. AI-powered embedded systems can process data instantly, reducing latency and improving decision-making.

Keywords: Smart Power, Intelligent Control

SMART TRAFFIC MANAGEMENT SYSTEM FOR URBAN CONGESTION

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Abstract: Urban congestion remains a major challenge in modern cities, leading to increased travel times, fuel consumption, and environmental pollution. A Smart Traffic Management System (STMS) offers an innovative solution by utilizing real-time data, Internet of Things (IoT) devices, artificial intelligence (AI), and predictive analytics to optimize traffic flow and reduce bottlenecks. This system integrates data from traffic sensors, surveillance cameras, GPS devices, and mobile applications to monitor road conditions and vehicle movement dynamically. Using AI-based algorithms, the STMS can adapt traffic signal timings, suggest alternative routes, and provide real-time traffic updates to commuters. Additionally, it enables authorities to respond promptly to accidents, road closures, and unexpected surges in traffic volume. By improving traffic efficiency and promoting smarter urban mobility, STMS contributes to sustainable urban development.

Keywords: Electric Vehicles, Renewable energy, IoT.

MEDICAL HELPER BOT USING AI

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Abstract: The rapid advancement of artificial intelligence (AI) and natural language processing (NLP) technologies has revolutionized the healthcare sector by enabling the development of intelligent medical helper bots. A medical helper bot is an AI-powered conversational agent designed to assist patients, healthcare providers, and administrative staff in a variety of healthcare-related tasks. These bots interact with users through text or voice, providing real-time information, guidance, and support. Core functionalities include symptom assessment, health education, appointment scheduling, medication reminders, mental health support, and patient data management. By leveraging machine learning algorithms and large-scale medical datasets, medical helper bots can provide personalized recommendations, triage patients efficiently, and reduce the workload of healthcare professionals. Furthermore, they enhance accessibility by offering healthcare support in multiple languages and at any time, addressing the limitations of traditional healthcare systems, especially in rural or underserved areas. However, despite their potential, medical helper bots are designed to assist rather than replace human professionals, emphasizing the importance of validation, ethical considerations, and data privacy. The integration of these bots into healthcare ecosystems promises improved patient engagement, operational efficiency, and proactive health management, marking a significant step toward digital transformation in healthcare.

Keywords: Anomaly Detection, Health care

IOT-BASED FAULT DETECTION IN UNDERGROUND CABLES

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Abstract:Power distribution networks are the backbone of modern societies, and underground cables are increasingly used due to their safety, reliability, and aesthetic benefits. However, faults in underground cables are difficult to detect, leading to prolonged outages, increased maintenance costs, and customer dissatisfaction. Traditional fault detection methods are time-consuming and inefficient. This paper proposes an Internet of Things (IoT)-based fault detection system that enables real-time monitoring, precise fault localization, and predictive maintenance in underground power cables. By integrating sensors, microcontrollers, and cloud based platforms, the system enhances fault detection efficiency and minimizes downtime, contributing to the development of smart power grids.

Keywords:IoT, Underground cables, Fault detection, Smart grid, Predictive Maintenance, Real-time Monitoring

CLOUD AND EDGE FEATURED BMS FOR EV

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Abstract:The rapid growth of electric vehicles and renewable energy storage has increased the demand for efficient and reliable Battery Management Systems (BMS). Traditional cloud-based monitoring solutions often face challenges such as dependency on continuous internet connectivity and difficulty in interpreting raw data. To address these limitations, this project proposes a Smart BMS that integrates Edge Computing and Cloud Computing in a hybrid architecture. The hardware implementation is based on an ESP32 microcontroller interfaced with an INA219 current sensor (I²C protocol), a DS18B20 temperature sensor (1-Wire protocol), and a voltage divider circuit for safe ADC scaling of Li-ion battery voltage. At the edge layer, the ESP32 performs real-time monitoring of voltage, current, and temperature, and locally calculates the State of Charge (SoC) as well as a novel Battery Health Index (BHI) that categorizes the battery status into green, yellow, or red zones. This enables failover monitoring through local alerts using buzzer and LED indicators, ensuring safety even when Wi-Fi or cloud connectivity is unavailable. At the cloud layer, data is uploaded via Wi-Fi and TCP/IP using MQTT or HTTP communication protocols to IoT platforms such as Thing Speak or Blynk. The cloud provides remote dashboards, real-time data visualization, and storage for trend analysis, thereby enhancing accessibility for users.

Keywords: Battery Management System (BMS), Edge Computing, Cloud Computing, Failover Monitoring, Hybrid Architecture, State of Charge (SoC), Battery Health Index (BHI).

DEEP LEARNING-BASED FAULT DETECTION AND PREDICTIVE MAINTENANCE IN SMART ELECTRICAL GRIDS

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Abstract: The growing complexity of modern power systems and the quick growth of renewable energy sources have made smart electrical grids more vulnerable to unexpected faults and equipment failures. Traditional fault detection methods often lack the speed, accuracy, and flexibility needed to keep the grid stable and reliable. To tackle these issues, this paper suggests a deep learning-based framework for fault detection and predictive maintenance in smart electrical grids. The approach uses neural network models to analyze real-time data from sensors, phasor measurement units (PMUs), and smart meters. By finding hidden patterns and anomalies, the system allows for early fault detection and provides precise predictions of equipment health. This not only reduces unplanned outages but also improves maintenance schedules, which lowers operational costs and extends asset life. The proposed method strengthens grid resilience, increases fault diagnosis accuracy, and helps the shift toward smart, self-healing power systems. Experimental results and case studies show how effective deep learning techniques can be in improving fault detection rates and ensuring proactive maintenance in modern smart grids.

Keywords: PMUs, Sensor, RTDS, Smartgrid.

INDUSTRIAL WIRELESS CONTROL AND MONITORING SYSTEM

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Abstract: Programmable logic controller holds an enviable position in automotive and industrial processes. A replacement for PLC's a wireless controlling monitor system has been designed to manage the operations of small and medium enterprises. The system has been designed to use ESP32 microcontroller based on esp now protocol. Hence the designed system facilitates to way communication with minimal wiring. The proposed system provides a cost-effective substitute for PLC-based configurations due to its adaptability and scalability, rendering industrial automation attainable for SMEs, startups, and workshops.

Keywords: Automation in Industry, ESP32, ESP-NOW, Wireless Management, Monitoring in Real-time, Internet of Things.

IOT BASED LIFT MONITORING AND CONTROL SYSTEM

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Abstract: The rapid advancement of the Internet of Things (IoT) has enabled smart automation in various domains, including building management systems. This project presents an IoT-based lift control and monitoring system designed to enhance safety, efficiency, and remote accessibility. The system integrates sensors for real-time lift status detection, load monitoring, and floor positioning, which are transmitted to a cloud platform via Wi-Fi. Users can monitor lift performance, occupancy, and fault alerts remotely through a web or mobile application. In addition, the system allows authorized users to control lift operations such as calling the lift or restricting access to specific floors. The proposed solution reduces maintenance costs by providing predictive maintenance alerts and ensures improved user safety by enabling immediate fault notifications. This IoT-enabled architecture demonstrates a scalable, cost-effective, and energy-efficient approach toward modernizing traditional elevator systems for smart buildings.

Keywords: IoT, Lift Monitoring, Remote Control, Smart Building, Predictive Maintenance, Automation

IOT BASED PARALYSIS PATIENT ASSISTING SYSTEM USING GSM

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Abstract: The Internet of Things (IoT) is revolutionizing healthcare by providing smart solutions for patient assistance and monitoring. This project presents an IoT-based Paralysis Patient Assisting System integrated with a GSM module to enhance communication and support for paralyzed patients. The system enables patients to convey their needs to caregivers through simple input mechanisms such as switches or sensors. Upon activation, predefined messages are transmitted via GSM to registered mobile numbers, ensuring timely response. Additionally, IoT connectivity allows remote monitoring of patient activity and emergency alerts, thereby reducing dependency and improving patient safety. The system is cost-effective, user-friendly, and designed to provide reliable assistance in both home and hospital environments. By combining IoT with GSM technology, the project addresses critical healthcare challenges and ensures a practical and efficient communication link between patients and caregivers.

Keywords: IoT, GSM, Paralysis Patient, Healthcare, Remote Monitoring, Patient Assistance, Emergency Alert.

IOT-BASED PREDICTIVE MAINTENANCE OF INDUCTION MOTOR

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Abstract: Industrial induction motors play a crucial role in manufacturing and automation systems, but sudden failures often result in costly downtime and productivity loss. Conventional maintenance strategies, such as preventive or corrective maintenance, are not always effective in anticipating unexpected faults. To address this challenge, this project proposes an IoT-based Predictive Maintenance System for induction motors. The system integrates sensors to continuously monitor key motor parameters such as temperature, vibration, current, and speed, with data acquisition handled by microcontrollers like ESP32 or NodeMCU. The collected data is transmitted to cloud platforms for real-time monitoring, analysis, and visualization. Advanced analytics are employed to predict potential faults and generate instant alerts, enabling timely intervention before breakdown occurs. This predictive approach reduces unplanned downtime, extends motor lifespan, enhances operational reliability, and contributes to smarter and more sustainable industrial practices. Furthermore, the solution is cost-effective, scalable, and adaptable across various industrial applications. By leveraging IoT and predictive analytics, industries can achieve higher efficiency, improved.

Keywords: Induction Motor, IoT, Predictive Maintenance, Arduino, ESP8266.

IOT-BASED SMART GRID WITH LOAD BALANCING AND DEMAND RESPONSE

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Abstract: The integration of the Internet of Things (IoT) in smart grids enables real-time monitoring, dynamic load balancing, and efficient demand response management. This paper presents an IoT-based architecture for optimizing power distribution, where smart sensors and controllers continuously monitor grid parameters and adjust loads to maintain system stability. A demand response mechanism is implemented to shift or reduce non-critical loads during peak demand periods. The proposed system improves grid efficiency, reduces energy losses, and enhances reliability by ensuring balanced load distribution. Simulation case studies demonstrate the effectiveness of IoT-enabled smart grids in achieving sustainable and intelligent energy management.

Keywords: Demand Response, Internet of Things (IoT), Load balancing, Smart grid, Energy Management

OPTIMIZING INDUSTRIAL MOTOR EFFICIENCY WITH AI-POWERED PREDICTIVE MAINTENANCE

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Abstract:Industrial motors constitute a major share of global electrical energy consumption, making their efficiency a critical factor in sustainable industrial operations. Conventional maintenance practices, such as reactive and preventive methods, often result in unplanned downtime, excessive energy use, and higher operational costs. This work proposes an AI-powered predictive maintenance framework to optimize industrial motor efficiency. By employing sensor-based monitoring, machine learning models, and predictive analytics, the system identifies early fault signatures, forecasts potential failures, and schedules maintenance proactively. The approach enhances energy efficiency, reduces downtime, lowers maintenance costs, and extends motor lifespan. Results from analytical evaluation indicate that integrating artificial intelligence with industrial motor management can significantly improve reliability and contribute to cost-effective, sustainable industrial practices.

Keywords:Industrial Motors, Predictive Maintenance, Artificial Intelligence, Machine Learning, Energy Efficiency, Condition Monitoring.

POWER GENERATION USING MICROTURBINES

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Abstract:This paper reports the design and development of power generation using microturbines. Represent a rapidly evolving distributed generation technology that has gained significant attention for their versatility, efficiency, and environmental benefits. This comprehensive review examines the current state of microturbine technology, addressing their operational principles, performance characteristics, control systems, and diverse applications. With power outputs ranging from 25 kW to 500 kW, these compact combustion turbines offer distinct advantages including low emissions, minimal vibration, fuel flexibility, and cost-effectiveness for combined heat and power (CHP) applications. Recent advancements in recuperator design, bearing technology, and power electronics have substantially improved their efficiency and reliability. The integration of silicon carbide semiconductors in power converters shows particular promise for enhancing switching frequencies and reducing system size and costs. This paper also explores the application of optimization algorithms for performance enhancement and discusses the role of microturbines in supporting grid stability amid growing renewable energy penetration.

Keywords:Microturbine, Distributed Generation, Combined Heat and Power (CHP), Recuperator, Waste Heat Recovery, Techno-Economic Analysis

REAL TIME PUBLIC TRANSPORT FOR SMALL CITIES

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Abstract:Public transportation systems in small cities often face challenges such as irregular schedules, lack of passenger information, and inefficient resource utilization. Unlike metropolitan areas, where advanced intelligent transport systems are common, small cities typically rely on traditional methods of operation, resulting in passenger inconvenience and reduced usage of public transit. This paper proposes the development of a real-time public transport system tailored for small cities, integrating GPS-enabled vehicles, cloud-based data processing, and mobile applications for users. The system provides live tracking of buses and shared vehicles, estimated time of arrival (ETA) notifications, route information, and occupancy details to enhance passenger convenience and confidence in using public transport. For operators, it enables better fleet management, optimized routes, and data-driven planning. By bridging the gap between affordability and technology, real-time public transport systems can significantly improve mobility, reduce traffic congestion, promote sustainable travel, and support the socio-economic growth of small cities.

Keywords: Real-Time Tracking, Intelligent Transportation System, IoT in Transportation, Passenger Information System, Smart Mobility, Urban Mobility, Sustainable Transportation

SMART AI BASED ACCIDENT DETECTION AND RESCUE SYSTEM

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Abstract:Road accidents are one of the leading causes of fatalities worldwide, primarily due to delayed emergency response and lack of real-time accident reporting. This paper presents an Accident Detection and Alert System using Arduino that integrates an accelerometer, GPS, and GSM modules to automatically detect vehicular accidents and promptly notify emergency services. The system continuously monitors acceleration data to identify abnormal changes indicating a collision. Upon accident detection, the GPS module retrieves the vehicle’s location, which is then transmitted through the GSM module as an emergency alert message to pre-defined contacts or authorities. Additionally, the system logs event data for post-accident analysis. Experimental results demonstrate that the proposed design provides a cost-effective, reliable, and real-time solution that can significantly reduce emergency response time and potentially save lives.

Keywords:Accident detection, Arduino, GPS, GSM, Emergency alert, IoT, Road safety

SMART AI – GENIE

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Abstract: This paper reports the design and development of Smart Ai-Genie, a handheld smart assistant device intended for daily safety and convenience. The system has multiple functionalities such as a lost item tracker, SOS distress alert button, battery recharge port, Bluetooth speaker, and offline translator packed in a small and affordable design reminiscent of ear pods. In contrast to traditional smart devices, Smart Ai-Genie prioritizes multi-functionality in compact form, and therefore is both functional and cost effective. The lost object locator uses BLE technology to identify lost items within a 10-meter radius, while the SOS button facilitates quick emergency notifications. A rechargeable onboard power system adds energy autonomy, and the Bluetooth speaker facilitates entertainment communications. Also, the offline translator offers consistent translation services independent of internet connectivity, attaining a rate of 85% accuracy in three local languages.

Keywords: Smart Assistant, SOS alert System, Bluetooth low energy(BLE), Offline translator, Portable intelligent device, IOT, Rechargeable Module, Multifunctional Gadget, safety and Convenience.

SMART CLASSROOM & TIMETABLE SCHEDULER

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Abstract: In the modern educational ecosystem, effective classroom management and optimized scheduling play a pivotal role in enhancing the learning experience. Traditional methods of timetable scheduling are often time-consuming, prone to conflicts, and lack adaptability to dynamic academic requirements. To address these challenges, this paper proposes a Smart Classroom and Timetable Scheduler framework that integrates digital technologies, automation, and intelligent resource allocation. The system focuses on streamlining timetable generation by minimizing clashes, efficiently utilizing classrooms and faculty, and providing real-time updates to stakeholders. Additionally, the smart classroom component leverages IoT, cloud storage, and interactive tools to create a digitally enriched environment that supports seamless teaching and learning. By combining automation with smart learning infrastructure, the proposed model ensures improved productivity, better resource utilization, and enhanced student engagement. This work highlights the potential of smart technologies in transforming traditional classrooms into intelligent, adaptive, and future-ready learning spaces.

Keywords: Smart Classroom, Timetable Scheduler, Automation, IoT, Digital Learning, Resource Optimization.

SMART ICU FAULT PROTECTION SYSTEM

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Abstract:In modern healthcare, the Intensive Care Unit (ICU) is the most critical area where an uninterrupted power supply is vital for life-supporting medical devices like ventilators, infusion pumps, patient monitoring systems, and emergency equipment. Traditional fault protection methods in hospital power systems often lack smart monitoring, quick fault detection, and preventive maintenance features. This paper introduces a Smart ICU Fault Protection System that uses IoT-enabled sensors, smart relays, and real-time monitoring platforms to ensure continuous, fault-tolerant power delivery. The system quickly detects issues such as overloads, leakage currents, short circuits, and phase imbalances within milliseconds. The proposed solution provides several benefits, including improved patient safety, less downtime, better power quality, and more efficient maintenance scheduling. Additionally, it supports remote monitoring through a cloud-based dashboard, allowing hospital staff to receive real-time alerts and performance analytics. Simulation and prototype results show that it improves fault response times (under 1 second) and offers greater reliability compared to traditional protection methods.

Keywords:Smart ICU, Fault protection system, IoT-enabled sensors, Smart relay, Real-time monitoring, Predictive fault detection.

SMART MULTI-SENSOR UNIT FOR INTEGRITY AND SAFETY

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Abstract:The Smart Multi-Sensor Unit for Building Integrity and Safety is designed as a low-cost intelligent monitoring solution for small-scale structures. The system integrates tilt, vibration, strain, flame, and temperature sensors with an Arduino Uno microcontroller, while Internet of Things (IoT) connectivity enables continuous remote monitoring through real-time data transmission. Artificial Intelligence (AI) techniques are applied to analyze sensor data, recognize abnormal patterns, and provide predictive insights into potential structural failures. Unlike conventional monitoring systems developed for large infrastructures, this compact unit offers an affordable and scalable option for residential buildings, schools, and hospitals in disaster-prone regions. The tilt and vibration sensors detect sudden movements caused by earthquakes or landslides, the strain gauge monitors structural deformation, and flame and temperature sensors provide early fire warnings.

Keywords:Structural health monitoring, IoT, Artificial Intelligence, Arduino Uno, Smart multi-sensor system, Building safety, Tilt detection, Vibration monitoring, Fire hazard detection, Early warning system, Low-cost solution, Disaster management.

SMART ROAD OBSTACLE DETECTOR WITH IOT

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Abstract: This article discusses the design and implementation of a Smart Road Obstacle Detector, an IoT system intended to improve road safety for motorists, pedestrians, and autonomous cars. The system makes use of a hybrid of ultrasonic sensors and a camera module to identify fixed and moving objects on the road, like potholes, debris, animals, or broken-down cars. Once detected, the device interprets the information through an embedded microcontroller and sends real-time notifications, such as the location of the obstacle via GPS, to a central cloud server. Notifications are then distributed to other motorists and the concerned authorities using a mobile app and web portal, establishing a proactive network of safety. The system is cost-effective, energy-efficient, and deployable on any existing infrastructure. Experimental outcomes exhibit high detection precision and low latency in alert generation, and a promising solution to enhance situational awareness and avoid accidents on smart roads.

Keywords: Road Safety, Obstacle Detection, Internet of Things (IoT), Ultrasonic Sensor, Computer Vision, Real-time Alert System, Smart Infrastructure, Cloud Computing.

SOLAR WIRELESS EV CHARGING SYSTEM WITH IOT

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Abstract: The increasing demand for electric vehicles (EVs) necessitates the development of efficient, intelligent, and sustainable charging solutions. Conventional plug-in charging systems suffer from drawbacks such as cable degradation, human dependency, and reliance on grid electricity. To address these challenges, this project proposes a Solar Wireless EV Charging System integrated with Artificial Intelligence (AI) and Machine Learning (ML) techniques. In the proposed design, solar photovoltaic (PV) panels generate renewable energy, which is stored and regulated through a power conditioning unit. Wireless power transfer (WPT) is achieved using inductive coupling between the transmitter coil embedded in the charging pad and the receiver coil installed on the EV. A resonant inverter ensures efficient high-frequency AC transfer for safe and contactless charging. AI and ML algorithms are incorporated to optimize system performance by predicting energy demand, managing battery health, and improving power transfer efficiency under varying environmental and load conditions. Additionally, predictive maintenance models enhance system reliability, while intelligent scheduling reduces charging delays and grid dependency.

Keywords: Solar energy, Wireless power transfer, Artificial intelligence, Machine learning, Electric vehicles, Smart charging.

TRANSFORMER LINE CONTINUITY MONITORING & ISOLATION WIRELESS HEARTBEAT AND IOT

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Abstract: This paper proposes a novel method for transformer line continuity monitoring and automatic isolation during line cut or fault conditions using a wireless heartbeat communication technique integrated with IoT. A transmitter node placed at the far end of the feeder line senses voltage through an optocoupler-based sensor and periodically sends a heartbeat signal to a controller located near the transformer. The controller monitors the signal, and if it is not received for a specified time, it assumes a line cut and triggers a relay to isolate the transformer, while an MQTT-based IoT module simultaneously sends real-time alerts to maintenance personnel. This system provides immediate detection of line cuts, enhances public safety, prevents transformer damage, and ensures rapid maintenance response. It is low-cost, scalable to multiple feeder lines using ESP32 with LoRa or GSM, and highly suitable for both rural and urban networks where overhead lines are prone to damage. Furthermore, it can be integrated into smart grid infrastructure for enhanced visibility and efficiency, while also serving as a valuable educational and research tool..

Keywords: Transformer Protection, IoT, ESP32, Line Monitoring, Heartbeat Signal, Auto-Isolation, Smart Grid, Real-Time Alerts, Predictive Maintenance, Fault Detection.

TOXIC GAS DETECTOR SYSTEM

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Abstract: Toxic gas detectors are essential safety devices designed to monitor, identify, and alert the presence of harmful gases in industrial, commercial, and domestic environments. With the growing concerns of occupational hazards, environmental pollution, and accidental gas leaks, the need for reliable detection systems has become increasingly significant. A toxic gas detector typically integrates gas sensors, a microcontroller, and an alerting system to ensure real-time monitoring and response. Sensors such as metal oxide semiconductor (MOS), electrochemical, or infrared are commonly employed due to their sensitivity and selectivity toward specific toxic gases like carbon monoxide (CO), methane (CH₄), hydrogen sulfide (H₂S), and ammonia (NH₃). Upon detection of concentrations above the permissible threshold, the system activates alarms such as buzzers, LEDs, or even IoT-enabled notifications to warn individuals and initiate preventive measures. Recent developments also focus on smart detection systems equipped with machine learning algorithms that can improve accuracy and reduce false alarms. Moreover, portability and affordability are emphasized to ensure broader adoption in developing regions where safety standards are often compromised. In conclusion, toxic gas detectors represent a vital technological solution to safeguard human health, prevent accidents, and promote sustainable working and living environments through continuous innovation and real-time hazard detection.

Key words: Toxic gas Detector, Safety System

ENHANCING EDUCATIONAL OUTCOMES WITH EXPLAINABLE AI: BRIDGING TRANSPARENCY AND TRUST IN LEARNING SYSTEM

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Abstract: Artificial Intelligence (AI) has become an increasingly integral part of modern education, powering adaptive learning platforms, automated assessment tools, and personalized tutoring systems. However, the "black-box" nature of many AI models poses challenges in terms of transparency, accountability, and trust, which are crucial in educational contexts. Explainable AI (XAI) offers a pathway to address these concerns by making AI-driven decisions more interpretable for learners, educators, and policymakers. This paper explores how XAI can enhance educational outcomes by improving trust in AI systems, enabling better feedback mechanisms, and fostering data informed pedagogical strategies. It highlights the role of transparency in supporting ethical AI adoption, reducing biases, and promoting fairness in personalized learning environments. Furthermore, it discusses design principles and implementation frameworks that balance technical accuracy with human interpretability. By bridging the gap between opaque algorithms and user understanding, XAI holds the potential to not only improve learning effectiveness but also strengthen confidence in AI-enabled education systems.

Keywords: Explainable AI (XAI), Trust in AI, Transparency, Learning System, Human–AI collaboration, Interpretability, Student engagement, Teacher support, Personalized learning, Decision-making in education

VEHICLE SAFETY SPEED CONTROLLER UNDER DRIVER FATIGUE USING EYE BLINK SENSOR WITH AI

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Abstract: Driver fatigue is a critical factor contributing to road accidents, especially during long-distance travel and night driving. This paper presents an intelligent Vehicle Safety Speed Controller system that detects driver fatigue using an eye blink sensor integrated with Artificial Intelligence (AI). The system continuously monitors the driver's eye blink patterns to assess alertness levels in real time. When signs of fatigue are detected—such as prolonged eye closure or reduced blink frequency—the AI algorithm triggers a speed control mechanism to gradually reduce vehicle speed, ensuring safety without abrupt intervention. The system also alerts the driver through audio-visual cues and can initiate emergency protocols if fatigue persists. The proposed model combines sensor data acquisition, AI-based fatigue classification, and automated vehicle control to create a responsive and preventive safety framework. Simulation results and prototype testing demonstrate high accuracy in fatigue detection and effective speed modulation, contributing to reduced accident risk. This research highlights the potential of AI-driven fatigue monitoring systems in enhancing road safety and promoting intelligent transportation solutions.

Keywords: Driver Fatigue, Eye Blink Sensor, Vehicle Safety, Speed Controller, Artificial Intelligence, Real-Time Monitoring, Accident Prevention, Intelligent Transportation System, Fatigue Detection, Human-Machine Interaction.

Design and Development of a Smart Electric Vehicle Prototype

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Abstract-This paper presents the design and development of a smart electric vehicle (EV) prototype that integrates intelligent control systems, energy-efficient powertrain components, and real-time connectivity to support the vision of sustainable and autonomous urban mobility. The prototype incorporates a lightweight chassis, a brushless DC motor powered by a lithium-ion battery pack, and a custom-designed energy management system optimized for performance and range. Smart features such as GPS navigation, IoT-based vehicle diagnostics, remote monitoring, and regenerative braking are implemented to enhance user experience and operational efficiency. The vehicle's control architecture is built around a microcontroller-based embedded system, enabling seamless communication between subsystems and facilitating data collection for future scalability. Initial testing demonstrates the prototype's feasibility in terms of energy consumption, system responsiveness, and adaptability to urban driving conditions. This work lays the foundation for further research in smart EV development, autonomous mobility integration, and eco-friendly transportation solutions for smart cities.

Keywords: *Smart electric vehicle (EV), Prototype development, Intelligent control systems, IoT-based diagnostics, Remote monitoring, Regenerative braking, Vehicle data collection, Eco-friendly vehicle design.*

Advancing Microgrid Resilience through Integration of Renewable Energy Sources: A Technical Approach

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Abstract-The integration of renewable energy sources (RES) with microgrids offers a transformative pathway toward sustainable and resilient energy systems. Microgrids, characterized by localized generation, distribution, and storage, can incorporate diverse RES such as solar photovoltaics, wind turbines, and biomass generators. This integration addresses challenges of intermittency, voltage stability, and power quality by deploying advanced control strategies, energy storage systems, and demand-side management. Hybrid architectures, combining conventional and renewable sources, enhance reliability while reducing greenhouse gas emissions. Smart inverters, real-time monitoring, and distributed energy management systems further optimize performance by balancing variable generation with dynamic load demands. Microgrids can operate in both grid-connected and islanded modes, enabling flexibility during grid outages and enhancing community energy security. The economic viability of such integration is strengthened by declining renewable technology costs and availability of policy incentives. Technical innovations, such as predictive analytics and adaptive protection schemes, ensure stability under fluctuating renewable penetration levels. This synergy supports national decarbonization targets, facilitates rural electrification, and enables urban energy independence. In essence, coupling RES with microgrids creates a modular, efficient, and environmentally friendly framework that addresses energy sustainability challenges while delivering long-term benefits to both utilities and end-users.

Keywords: *Renewable Energy, Microgrid, Energy Storage, Smart Inverters, Hybrid Systems, Power Quality, Grid Stability, Energy Management, Predictive Analytics, Decarbonization*

Industrial Automation Using PLC and SCADA for Smart Manufacturing

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Abstract-The advent of smart manufacturing has revolutionized industrial processes by integrating advanced automation technologies to enhance efficiency, precision, and flexibility. This paper explores the implementation of industrial automation through Programmable Logic Controllers (PLCs) and Programmable Logic Controllers (SCADA) systems to enable intelligent monitoring and control of manufacturing operations. PLCs provide robust, remote management and production lines, while SCADA systems offer centralized data visualization, process supervision, and remote management capabilities. Together, they facilitate seamless communication between sensors, actuators, and control units, enabling rapid response to process variations and minimizing downtime. The integration of PLC and SCADA in smart manufacturing environments leads to improved production quality, resource optimization, and predictive maintenance, supporting the evolution towards Industry 4.0. This study demonstrates how the synergy of these technologies contributes to operational excellence and competitive advantage in modern industrial settings.

Keywords: *Smart Manufacturing, Industrial Automation, Programmable Logic Controller (PLC), Supervisory Control and Data Acquisition (SCADA), Real-Time Monitoring, Process Control, Remote Management, Data Visualization, Sensor Integration, Actuator Control, Predictive Maintenance, Resource Optimization*

Design and Control of a BLDC Motor For Electric Vehicles

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Abstract-The growing demand for efficient and sustainable transportation has accelerated the development of electric vehicles (EVs), placing brushless DC (BLDC) motors at the forefront due to their high efficiency, compact size, and superior torque characteristics. This paper presents the comprehensive design and control of a BLDC motor tailored for electric vehicle applications. The design process encompasses motor sizing, electromagnetic analysis, and thermal considerations to meet performance and efficiency targets. A sensorless control strategy using back-EMF detection is implemented to enhance system reliability and reduce cost. Additionally, advanced control algorithms, including field-oriented control (FOC) and PI tuning, are integrated to ensure smooth torque production, dynamic response, and improved energy efficiency. Simulation results using MATLAB/Simulink, along with hardware validation, demonstrate the effectiveness of the proposed design and control methodology. The outcomes confirm the potential of optimised BLDC motor systems to significantly enhance the performance and viability of modern electric vehicles.

Keywords: *Brushless DC (BLDC) Motor, Electric Vehicles (EVs), Motor Design, Sensorless Control, Back-EMF Detection, MATLAB/Simulink Simulation, Hardware Validation, Torque Control, Dynamic Response.*

Smartphone App For Tracking And Managing EV Performance Metrics

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Abstract-With the rapid adoption of electric vehicles (EVs), the need for user-friendly tools to monitor and manage vehicle performance has become increasingly important. This paper presents the development of a smartphone application designed to track and analyze key EV performance metrics in real time. The app interfaces with the vehicle's onboard systems via Bluetooth or CAN bus to collect data such as battery state of charge (SoC), energy consumption, motor temperature, speed, and regenerative braking efficiency. A clean and intuitive user interface allows users to visualize historical and real-time data, set efficiency goals, and receive alerts related to maintenance or abnormal performance patterns. The system architecture emphasizes modular design, data security, and cross-platform compatibility. Testing on prototype EV platforms confirms the app's reliability and effectiveness in enhancing user awareness and promoting energy-efficient driving behavior. This application serves as a bridge between drivers and their electric vehicles, enabling smarter and more sustainable transportation.

Keywords: *Smartphone App, Electric Vehicle (EV), Performance Tracking, Battery Management, Real-Time Monitoring, EV Metrics, Mobile Application, State of Charge (SoC), Energy Consumption, Vehicle Diagnostics, User Interface, Data Visualization, Wireless Communication, Predictive Maintenance, Smart Mobility.*

IoT Based Multipurpose Agri Bot Using Solar Energy

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Abstract-Agriculture is seen as the foundation of human life because it provides food, grains, and other essential materials. It is important for a country's economy and offers many jobs. For a country to grow economically, the agriculture sector must also grow. However, many farmers still use old farming methods, which lead to poor crop and fruit production. In places where automation is used, crop yields have improved. So, it's important to use modern science and technology in agriculture to increase production. This project is about creating an IoT-based agricultural robot that runs on solar power. The robot is designed to make farming more efficient by automating tasks like checking the soil, watering crops, and assessing their health. With sensors and IoT technology, the robot gathers real-time data, helping farmers make better decisions. The solar power system makes it eco-friendly and lowers running costs. The robot can also be programmed for various uses, making it flexible for different farming needs. It also automates ploughing and seeding at specific intervals, enhancing crop yield and soil preparation while reducing manual labor. It features environmental monitoring with a DHT11 sensor that measures temperature and humidity, automatically activating a solenoid valve for targeted irrigation when thresholds are crossed. The AgriBot employs an L298N motor driver for autonomous navigation, using ultrasonic sensors to detect and avoid obstacles, ensuring safe movement in diverse agricultural environments. This project shows how technology can help modern agriculture become more productive and sustainable.

Keywords: *IOT, Agriculture Automation, ESP32, Solar Energy, Irrigation Control, Agricultural Robot*

Empowering Communities through Renewable Energy-Based Microgrids: Socio-Economic and Sustainability Insights

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Abstract—Integrating renewable energy sources (RES) within microgrids presents a strategic solution to meet growing energy demands while addressing global climate change objectives. Microgrids powered by RES, including solar, wind, hydro, and biomass, offer localized, clean, and efficient energy production that reduces dependence on fossil fuels. This approach fosters energy equity by delivering reliable electricity to rural and remote communities, enhancing social development and economic productivity. The hybrid nature of microgrid systems—combining renewables with storage technologies—ensures stable and uninterrupted supply despite the variability of RES. From an economic viewpoint, the integration reduces operational costs, stimulates job creation in clean energy sectors, and opens up investment opportunities in distributed generation infrastructure. Policy support and regulatory frameworks significantly influence deployment, enabling incentives and subsidies that boost adoption rates. Additionally, community-led microgrid projects encourage local ownership, capacity building, and sustainable business models. The environmental benefits are substantial, with measurable reductions in carbon emissions and improved air quality. Long-term, RES-based microgrids contribute to energy resilience against climatic and geopolitical disruptions, while aligning energy systems with global sustainable development goals. This synergy between technology, policy, and community engagement shapes a greener, more inclusive, and economically viable energy future.

Keywords: *Renewable Energy, Microgrid, Energy Equity, Rural Electrification, Job Creation, Policy Support, Sustainability, Community Development, Economic Growth, Carbon Reduction*

Smart Helmet For Electrical Workers With Hazard Detection

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Abstract—Electrical workers face significant risks due to exposure to hazardous environments, including electrical shocks, arc flashes, and falling objects. This paper presents the design and development of a smart helmet equipped with advanced hazard detection capabilities to enhance worker safety. The helmet integrates sensors for detecting electrical faults, proximity to live wires, temperature anomalies, and impact forces. Real-time data is processed by an embedded system to alert the wearer through visual, auditory, and haptic feedback mechanisms. Additionally, the helmet supports wireless communication to notify supervisors instantly in case of critical hazards, enabling swift emergency response. The smart helmet aims to reduce workplace accidents, improve situational awareness, and promote a safer working environment for electrical professionals. This innovative solution embodies the intersection of wearable technology and industrial safety, contributing to the future of smart personal protective equipment (PPE).

Keywords: *Smart Helmet, Electrical Workers, Hazard Detection, Wearable Safety Technology, Electrical Shock Prevention, Arc Flash Detection, Real-Time Monitoring, Embedded Systems, Wireless Communication, Workplace Safety, Personal Protective Equipment (PPE), Industrial Safety, Sensor Integration, Emergency Alert System.*

Implementation of Home Automation Using Google Assistant And Blynk

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Abstract-Home automation using Google Assistant and Blynk enables users to control household devices through voice commands. Blynk is an open-source mobile platform with its own cloud server that processes user requests. It allows users to control devices, monitor sensor data, and receive notifications based on specific trigger actions. The system integrates with the IFTTT website, where voice commands for Google Assistant are configured. When a user gives a command to Google Assistant, home appliances such as lights, fans, and motors can be operated accordingly. The NodeMCU (ESP8266) microcontroller is used for this system, and communication between the device and the application takes place via Wi-Fi. With continuous advancements in automation technology, daily life has become more convenient and efficient. In the modern era, automated systems are increasingly preferred over manual operation. The rapid growth of internet users has made the Internet an essential part of everyday life, and the Internet of Things (IoT) has emerged as one of the most innovative and fast-growing technologies in this field.

Keywords: *Home automation, Google Assistant, Blynk, IoT, NodeMCU, ESP8266, Wi-Fi, voice control, smart home, IFTTT, sensors, cloud, and automation.*

FREQUENCY DROOP CONTROL IN ISLANDED MICROGRIDS

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Abstract-As microgrids continue to integrate distributed energy resources (DERs), maintaining stable operation in islanded mode has become crucial. Frequency droop control remains a widely adopted decentralized strategy due to its simplicity and ability to share power among parallel inverters without requiring communication. However, conventional droop methods often exhibit limited dynamic performance and are sensitive to parameter variations, especially under rapidly changing load conditions. This paper presents an improved frequency droop control method using a PWM controller within a layered control system to achieve better power sharing and faster response in islanded microgrids. The proposed method effectively maintains system frequency and voltage stability while enabling scalable coordination among inverter-based sources. The attached simulation demonstrates the performance characteristics and suitability for reliable, autonomous microgrid applications.

Keywords: *Distributed Energy Resources, Frequency Droop, Conventional Droop, Decentralized Strategy, microgrids, scalable coordination, inverter based resources, Autonomous microgrid applications.*

Leveraging Machine Learning: A Review of Transformative Applications in Healthcare and Agriculture

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Abstract-Artificial Intelligence (AI), Deep Learning (DL) and Machine Learning (ML), are state of the art technologies propelling innovation across numerous areas of everyday life. This research explores the transformative potential of leveraging Machine Learning to enhance outcomes in both Healthcare and Agriculture. Human health metrics like respiratory rate, heart impulse, blood pressure, oxygen saturation, and nerve conduction are regularly measured by medical devices, providing essential knowledge about a person's health. Various ECG parameters, including P, T waves, QRS complex, and ST interval, is useful for analyzing and forecasting human cardiac conditions such as myocardial infarction, sinus tachycardia, and pulmonary embolism. The processing and analysis of these bio-signals are carried out using Python's ML toolboxes, enabling clinicians to obtain real-time, non-invasive health data, thus improving medical interventions. Likewise, Machine Learning is revolutionizing smart farming by enhancing agricultural practices. Advanced algorithms drive precision farming by forecasting crop yields, predict crop disease, assessing soil health, and optimizing resource management. In addition, disease detection in potato leaves is implemented using TensorFlow. By leveraging these technologies, we can enhance medical diagnostics and agricultural efficiency, resulting in better health outcomes and sustainable food production.

Keywords: *Machine Learning, Artificial Intelligence, Deep Learning, CNN, ECG, Smart farming*

ETHICAL ISSUES AND CHALLENGES IN AI-APPLICATIONS

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Abstract-Artificial Intelligence (AI) has transitioned from theoretical research to practical implementation, profoundly impacting various real-world sectors. This paper examines the diverse applications of AI technologies in industries such as healthcare, finance, manufacturing, transportation, and customer service. AI-powered systems enable enhanced data analysis, predictive modeling, automation, and personalized user experiences, driving efficiency and innovation. Real-world deployments of AI involve challenges including data quality, ethical considerations, and system scalability, which require careful management. By integrating machine learning, natural language processing, and computer vision, AI solutions are transforming traditional workflows, optimizing resource utilization, and enabling smarter decision-making. This study highlights the critical role of AI in addressing complex problems and its potential to reshape industries through intelligent automation and advanced analytics.

Keywords: *Artificial Intelligence, Real-World Applications, Machine Learning, Predictive Modeling, Automation, Healthcare AI, Financial Technology, Manufacturing Automation, Natural Language Processing, Computer Vision, Ethical AI, Data Analytics, Intelligent Systems, Industry 4.0, AI Challenges.*

HYBRID SOLAR-WIND POWER SYSTEM WITH IOT-BASED MONITORING

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Abstract—The increasing demand for sustainable and renewable energy sources has led to the development of hybrid power systems that combine multiple energy generation methods. This paper presents the design and implementation of a Hybrid Solar-Wind Power System integrated with an IoT-based monitoring framework. The system harnesses solar and wind energy to provide a more reliable and continuous power supply, especially in remote or off-grid areas. Key components include photovoltaic panels, a wind turbine, charge controllers, a battery storage unit, and a microcontroller-based energy management system. To enhance functionality and real-time decision-making, the system is equipped with IoT sensors to monitor parameters such as voltage, current, power output, battery level, and environmental conditions. Data collected is transmitted to a cloud platform, enabling remote monitoring and analytics through a user-friendly web or mobile interface. This hybrid system not only improves energy efficiency and reliability but also empowers users with actionable insights for system maintenance and energy optimization.

Keywords: *Hybrid Power System, Solar-Wind Energy, Renewable Energy, IoT-Based Monitoring, Energy Management System.*

IMPROVED EFFICIENCY AND RELIABILITY OF A SINGLE-STAGE SOLAR WATER PUMPING SYSTEM

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Abstract—The demand for sustainable and energy-efficient water pumping solutions has driven the development of solar-powered systems, particularly in remote and off-grid areas. This paper presents an improved design of a single-stage solar water pumping system aimed at enhancing both efficiency and reliability. By optimizing the integration of photovoltaic (PV) panels with a high-efficiency pump and advanced control strategies, the system maximizes water output while minimizing energy losses. Key innovations include the use of maximum power point tracking (MPPT) algorithms, improved motor-pump coupling, and real-time monitoring to adapt to changing solar irradiance and load conditions. The system also incorporates fault detection mechanisms to ensure long-term operational stability. Experimental results demonstrate significant improvements in overall system performance, making this approach viable for sustainable agricultural irrigation and rural water supply.

Keywords: *Solar Water Pumping, Single-Stage Pump, Photovoltaic System, Maximum Power Point Tracking (MPPT), Energy Efficiency, Reliability, Sustainable Irrigation, Renewable Energy, Water Resource Management, Remote Area Solutions, Fault Detection, Real-Time Monitoring.*

IOT-BASED SMART VEHICLE SYSTEM FOR DRUNKEN DRIVING PREVENTION

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Abstract—Drunken driving remains one of the leading causes of road accidents, injuries, and fatalities worldwide. Traditional alcohol detection methods are limited to manual roadside checks, which are neither continuous nor reliable. To overcome this challenge, we propose an IoT-based smart automobile safety system that can automatically detect alcohol consumption by the driver in realtime. The system integrates an MQ-3 alcohol sensor with an ESP32 microcontroller to monitor the driver's breath every few minutes. If alcohol presence is detected above a predefined threshold, the system immediately triggers a buzzer for alert, activates a camera module for live video streaming to the registered family member, and simultaneously transmits the vehicle's GPS location using a GSM module. This ensures family members and authorities can take prompt action to prevent accidents. The prototype serves as an effective solution towards enhancing road safety, reducing drunken driving incidents, and promoting responsible driving behavior.

Keywords: *IoT, Alcohol Detection, Smart Vehicle, Road Safety, Drunken Driving Prevention*

STRATEGIES TO OPTIMIZE BATTERY OPERATION TO MINIMIZE THE ELECTRICITY COST IN A MICROGRID WITH RENEWABLE ENERGY SOURCES AND ELECTRIC VEHICLE

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Abstract—The growing integration of renewable energy sources (RES) and electric vehicles (EVs) in modern microgrids presents new opportunities for sustainable and resilient energy systems, while also introducing challenges in energy management and battery optimization. This paper proposes an intelligent, sensor-driven approach for optimizing battery operations in microgrids with dynamic RES and EV participation. Smart sensors continuously monitor parameters such as energy generation, load demand, battery state-of-charge, and EV usage to enable real-time adaptive control and predictive decision-making. The proposed system enhances cost efficiency, reliability, and battery health while maximizing renewable energy utilization. This holistic framework demonstrates a scalable solution for next-generation microgrid management, integrating real-time data analytics and advanced control strategies to support cleaner and smarter energy networks

Keywords: *Renewable energy sources, Electric vehicles, Microgrid, Battery optimization, Smart sensors, Real-time control, Energy management, Data analytics, Predictive control, Sustainable energy systems*

THERMOELECTRIC GENERATOR USING SP1848-27145

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Abstract—The increasing global demand for renewable and sustainable energy has created significant interest in alternative methods of electricity generation. Thermoelectric generators (TEGs) are solid-state devices that utilize the Seebeck effect to directly convert temperature gradients into electrical power. Unlike conventional energy systems, TEGs have no moving parts, produce no emissions, and require minimal maintenance, which makes them highly suitable for applications where reliability and compactness are essential. This project focuses on the design, fabrication, and experimental testing of a thermoelectric generator using the SP1848-27145 module. Measurements of open-circuit voltage, load current, and power output were recorded for various thermal gradients to evaluate performance. The results indicate that the SP1848-27145 module can generate an open-circuit voltage of up to 4.8 V when exposed to a temperature difference of approximately 150 °C, with a maximum power output of about 3.5 W under optimized load conditions. These findings confirm that although the overall efficiency of thermoelectric conversion is relatively low compared to conventional power generation technologies, the module demonstrates advantages such as durability, low cost, scalability, and ease of integration. Furthermore, this work highlights the practical potential of thermoelectric technology for small-scale applications, including powering low-power electronic devices, wireless sensors, and portable charging circuits. More importantly, it emphasizes the role of TEGs in waste heat recovery, where excess heat from industrial processes, automotive exhaust systems, or domestic appliances can be harvested as a supplementary energy source.

Keywords: *Thermoelectric Generator, SP1848-27145, Seebeck Effect, Energy Harvesting, Renewable Energy*

EVS AND GRID LOAD: A STUDY OF SMART CHARGING IN SMART CITIES

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Abstract—The rapid adoption of electric vehicles (EVs) presents both opportunities and challenges for urban energy systems, particularly in the context of smart cities aiming to integrate sustainable transportation with resilient power infrastructure. As EV penetration increases, unmanaged charging patterns risk overloading local grids, exacerbating peak demand and compromising grid stability. This study explores the role of smart charging strategies in mitigating grid load impacts while optimizing energy use in urban environments. Using real-world consumption data and simulation models, we analyze various smart charging scenarios—time-of-use pricing, vehicle-to-grid (V2G) integration, and demand response mechanisms—within a smart city framework. The findings demonstrate that coordinated charging can significantly reduce peak load stress, enhance renewable energy utilization, and contribute to overall grid reliability. Furthermore, policy recommendations and system architecture are proposed for effective implementation of smart EV charging infrastructure, highlighting the synergy between intelligent mobility and smart grid technologies. This research underscores the critical role of data-driven, adaptive charging systems in enabling sustainable urban electrification and energy transition.

Keywords: *Electric vehicles (EVs), Smart charging, Grid load management, Smart cities, Energy transition, Charging infrastructure, Simulation modelling.*

BATTERY MANAGEMENT SYSTEM (BMS) FOR ELECTRIC VEHICLES WITH REAL-TIME MONITORING

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Abstract-The increasing adoption of electric vehicles (EVs) necessitates efficient and reliable battery management systems (BMS) to ensure optimal battery performance, longevity, and safety. This paper presents a comprehensive Battery Management System designed for electric vehicles, incorporating real-time monitoring and control capabilities. The proposed BMS continuously monitors key battery parameters such as voltage, current, temperature, and state of charge (SoC) using advanced sensors and embedded systems. Real-time data acquisition enables dynamic balancing of battery cells, thermal management, and fault detection to prevent overcharging, deep discharging, and overheating. Furthermore, the system supports wireless communication for remote monitoring and diagnostic purposes, enhancing maintenance efficiency and user safety. The integration of real-time monitoring with intelligent control algorithms optimizes battery utilization, extends service life, and improves overall vehicle performance, contributing to the sustainable advancement of electric mobility.

Keywords: *Electric Vehicles (EVs), Battery Management System (BMS), Real-Time Monitoring, BatteryPerformance, BatteryLongevity, Intelligent Control Algorithm, Sustainable Mobility.*

REAL-TIME IOT-BASED SMART GRID MONITORING AND CONTROL SYSTEM

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Abstract-The rapid growth in energy demand, integration of renewable energy sources, and the need for efficient energy management have driven the evolution of traditional power systems into Smart Grids. This project presents Smart Grid IoT, a real-time IoT-based smart grid monitoring and control system designed to enhance energy efficiency, reliability, and sustainability. The system employs IoT sensors such as current, voltage, and power sensors to monitor electrical parameters across the grid in real time. Microcontrollers like ESP32 or Raspberry Pi collect this data and transmit it to a cloud-based platform (e.g., Firebase, AWS IoT, or Things Board) via MQTT/HTTP protocols. The cloud platform provides data storage, visualization, and analytics, enabling users and utilities to make informed decisions about energy usage. In addition, the system includes a load management module that can automatically or manually control electrical appliances using relay circuits based on real-time conditions. Users are notified of overloads, voltage drops, or abnormal consumption through alerts. Integration of renewable energy sources such as solar panels and energy storage units is also supported to promote clean energy usage. The proposed Smart Grid IoT system offers a scalable and cost-effective solution for smart homes, campuses, and rural electrification projects. It improves grid visibility, optimizes load distribution, reduces energy wastage, and lays the groundwork for future innovations such as AI-based load forecasting and blockchain-based energy trading.

Keywords: *AWS IoT, MQTT/HTTP, ESP32, Raspberry Pi, Electric Vehicles, Renewable energy, IoT.*

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WEB DEVELOPMENT AI SEARCH ENGINE

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Abstract: In today’s digital era, the demand for accurate, fast, and personalized information retrieval is rapidly increasing, making intelligent search engines an essential part of modern web applications. Traditional search engines rely heavily on keyword-based indexing and ranking mechanisms, which often fail to capture user intent or deliver contextually relevant results. To address these challenges, the concept of an AI-powered search engine for web development emerges as a transformative solution. By integrating artificial intelligence techniques such as natural language processing (NLP), semantic analysis, and machine learning, this system enhances the way users interact with web-based content. This approach ensures that users receive more precise and meaningful search results tailored to their needs. Key features include voice-based search, personalized recommendations, intelligent filtering, and support for multilingual queries. These capabilities position the AI search engine as not only a tool for retrieving data but also as a smart assistant that anticipates user requirements. From a development perspective, the system is built with scalable and modular web technologies, ensuring seamless integration with existing platforms and APIs. Security, privacy, and ethical considerations are central to its design, safeguarding user data while maintaining transparency in recommendation mechanisms. This project demonstrates how AI-driven search engines can revolutionize web development by bridging the gap between human language and machine understanding.

Keywords: Natural language processing, Semantic analysis, Contextual embeddings, Voice-based search, User indent, Multilingual series, Intelligent web experiences.

HARNESSING MECHANICAL ENERGY FOR POWER GENERATION FROM SPEED BREAKERS

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Abstract: The increasing demand for electricity and the finite nature of conventional energy sources necessitates the development of alternative power generation methods. This project proposes a novel approach to harnessing mechanical energy from moving vehicles on roads and converting it into usable electrical energy. The system is designed around a specially engineered speed breaker that compresses under the weight of a vehicle. This compression drives a rack and pinion mechanism connected to a DC generator. The generated power is then stored in a battery bank for later use. This stored energy can be used to power various small-scale applications, such as streetlights, traffic signals, and road signs. The system is scalable and can be installed in a series to maximize energy capture. The project's design is low-maintenance, robust, and cost-effective, making it a viable option for implementation in urban and rural areas. This technology offers a sustainable and innovative solution to the energy crisis by utilizing a readily available and often overlooked energy source. By implementing this system, we can reduce reliance on non-renewable sources, mitigate carbon emissions, and contribute to a greener future. The power generated could also be used to provide electricity to underserved communities, thereby promoting socio-economic development.

Keywords: Power generation, speed breaker mechanism, renewable energy, non-conventional energy, kinetic energy harvesting, rack and pinion mechanism, piezoelectric energy conversion.

IOT HEART ATTACK DETECTION & HEART RATE MONITOR

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Abstract: The Internet of Things (IoT) is entombing correspondence of installed gadgets utilizing organizing advancements. The IoT will be one of the significant patterns in future; can influence the systems administration, business and correspondence. Right now, a remote detecting parameter of the human body which comprises of heartbeat and temperature. The parameters that are utilized for detecting and observing will send the information through remote sensors. Including an online watching assist with monitoring the standard wellbeing status of a patient. The detecting information will be consistently gathered in a database and will be utilized to advise patient to any inconspicuous issues to experience conceivable conclusion. Trial results demonstrate the proposed framework is easy to understand, solid, affordable.

Keywords: *IoT, Heart rate sensors, Health monitoring, Health diagnosis.*

VOICE-CONTROLLED HOME AUTOMATION SYSTEM

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Abstract: Voice-controlled home automation is an advanced technology that enables users to control home appliances and devices using speech commands, thereby providing convenience, energy efficiency, and enhanced accessibility. This system leverages technologies such as speech recognition, natural language processing, and IoT-based communication to ensure seamless interaction between the user and household appliances. The voice interface eliminates the need for manual switches or remote controls, making it particularly useful for elderly and physically challenged individuals. The system architecture generally includes a microphone or smart speaker for input, a microcontroller or embedded system for processing, and wireless communication protocols like Wi-Fi, Bluetooth, or ZigBee for device control. Cloud-based integration with platforms such as Google Assistant, Amazon Alexa, or custom speech engines further enhances flexibility. The home automation system controls lighting, fans, air conditioners, televisions, security systems, and even kitchen appliances, all through voice commands. Low-power microcontrollers and energy-efficient communication protocols ensure sustainability and reduced electricity consumption. Security and privacy are ensured by encrypted communication and user authentication mechanisms.

Keywords: *Handwritten Digit Recognition, Artificial Intelligence, Machine Learning, Deep Learning, Neural Networks, Computer Vision, Convolutional Neural Networks (CNN)*

FAKE NEWS DETECTION

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Abstract: The rapid growth of online news and social media platforms has enabled faster communication but also contributed to the spread of misinformation, commonly referred to as fake news. Fake news can mislead the public, incite social unrest, and erode trust in democratic systems. Due to the impracticality of manual verification at scale, automated solutions are essential. Machine learning (ML) provides effective techniques for detecting fake news by analysing linguistic patterns, contextual cues, and statistical features in text. The detection process typically involves text pre-processing, feature extraction and classification using algorithms such as Logistic Regression, Naïve Bayes, SVM, Random Forest, LSTM, and Transformers. Benchmark datasets like LIAR and Fake Newsnet are used for training and evaluation. Performance is assessed using metrics such as accuracy, precision, recall, and F1-score. While traditional ML models perform reasonably well, deep learning and advanced NLP techniques have led to significant improvements in understanding context. Future directions include developing explainable AI, multimodal detection systems, and real-time frameworks to ensure the credibility of online content.

Keywords: Fake news detection, machine learning, natural language processing, text classification, misinformation, deep learning, feature extraction, BERT, TF-IDF.

SMART HOME WITH AI VOICE ASSISTANT

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Abstract: The rapid growth of smart technologies has transformed the way humans interact with their living spaces. Traditional home automation systems often lack adaptability, personalized control, and seamless communication. To overcome these limitations, this project proposes an AI-powered smart home system with an integrated voice assistant that enables intuitive, real-time, and intelligent interaction with household devices. Using a combination of IoT-enabled sensors, microcontrollers, and AI-driven voice recognition, the system can manage lighting, appliances, security, and environmental conditions. The voice assistant provides hands-free control, personalized automation routines, and quick access to essential services. By enabling remote monitoring and control through mobile and cloud platforms, the system ensures convenience, safety, and energy efficiency. The proposed system enhances the concept of next-generation living by delivering a sustainable, secure, and user-friendly smart home ecosystem. It reduces manual effort, improves lifestyle comfort, and supports modern living standards by integrating intelligence into everyday environment.

Keywords: 6PDUW Home, IoT-enabled Automation, AI Voice Assistant, Home Security, Energy Efficiency, Next Gen Living, Real-time Monitoring, Intelligent Control Systems.

A COMPREHENSIVE REVIEW OF ARTIFICIAL INTELLIGENCE IN EMERGING TECHNOLOGY APPLICATIONS

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Abstract: This project presents a sustainable grass cutting system powered entirely by solar energy. It integrates photovoltaic panels with a DC motor-driven cutting blade. The system is designed for small-scale agricultural and residential use. Solar energy is stored in rechargeable batteries for continuous operation. A microcontroller regulates power flow and motor speed. The design eliminates the need for fossil fuels or grid electricity. It reduces carbon emissions and promotes eco-friendly landscaping. The system includes safety features like blade guards and emergency shutoff. Lightweight materials ensure portability and ease of use. The cutting mechanism is optimized for various grass types and densities. Real-time monitoring of battery status and motor performance is implemented. The system operates autonomously or via manual control. It is tested under different sunlight and terrain conditions. Efficiency metrics include cutting speed, energy consumption, and runtime. The project supports green technology adoption in rural areas. Maintenance requirements are minimal due to simple mechanical design. Cost analysis shows affordability for low-income communities. The system aligns with renewable energy and sustainability goals. It serves as a model for clean energy-powered agricultural tools. This innovation contributes to climate-conscious land management.

Keywords: Fake news detection, machine learning, natural language processing, text classification, misinformation, deep learning, feature extraction, BERT, TF-IDF.

ADVANCED HUMAN PRESENCE DETECTION AND ENHANCING SECURITY IN ARMY SECTORS

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Abstract : Ensuring the safety and security of army sectors is a critical task that demands rapid, reliable, and intelligence surveillance solutions. Traditional monitoring systems often face challenges such as blind spots, low accuracy in adverse environments, and delayed threat identification. To overcome these limitations, this project proposes an advanced human presence detection system integrated with modern security frameworks. Using a combination of infrared sensors, ultrasonic sensors, pressure sensor and AI driven computer vision algorithms, the system can detect, classify, and track human movements even in low visibility condition such as darkness, fog or camouflage attempts. Real-time alerts are transmitted to command centre, enabling quick decision-making and deployment of countermeasures

Keywords: IOT, enabled security, Battlefield security, Enemy detection.

AI BASED FIRE AND GAS DETECTION SYSTEM USING IOT SENSORS

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Abstract: Fire and gas accidents are among the most dangerous hazards, causing loss of life, property damage, and environmental risks. Traditional detection systems often face limitations such as delayed response and false alarms. To overcome these challenges, this project proposes an AI-based fire and gas detection system using IoT sensors. The sensors monitor key environmental parameters such as temperature, smoke density, and gas concentration in real time. Data collected from the sensors is transmitted to a processing unit for analysis. Artificial intelligence algorithms process this data to identify abnormal patterns and accurately distinguish between real threats and false triggers. Once a hazard is detected, the system generates instant alerts through cloud platforms and mobile applications. This enables users or authorities to respond quickly and take preventive measures. The integration of AI ensures improved accuracy and predictive capability, while IoT provides real-time connectivity and scalability.

Keywords: AI, Internet of Things (IoT), Fire Detection, Gas Detection, Smart Safety System, Real-Time Monitoring, Sensor Network, Alert System, Predictive Analysis, Industrial Safety

AI BASED IMAGE PROCESSING FOR VEHICLES

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Abstract: Artificial Intelligence (AI) has emerged as a transformative force in intelligent transportation systems, with image processing playing a central role in enabling smarter and safer vehicles. AI-based image processing techniques empower vehicles to perceive and interpret their environment in real time through camera and sensor data. By leveraging deep learning and machine learning models, particularly Convolutional Neural Networks (CNNs), vehicles can detect, classify, and track objects such as pedestrians, vehicles, obstacles, and road signs with high accuracy. Advanced frameworks like YOLO and Faster R-CNN enhance real-time object detection, making autonomous decision-making faster and more reliable. Lane detection, road boundary recognition, and traffic sign identification further support navigation and compliance with traffic rules. Pedestrian detection and collision avoidance improve urban driving safety, while thermal and infrared imaging extend visibility under poor lighting and adverse conditions. With the integration of edge computing and cloud-based training, image processing systems achieve greater efficiency, adaptability, and scalability. Sensor fusion techniques enhance robustness by combining multiple data streams, while predictive analytics enable proactive driving responses.

Keywords : IOT, enabled security, Battlefield security, Enemy detection.

AI BASED INTELLIGENT PNEUMONIA DETECTION SYSTEM IMPLEMENTED IN PYTHON

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Abstract: This project presents an AI-driven solution for rapid and accurate pneumonia detection from chest X- ray images, developed for a hackathon environment. Leveraging Python with deep learning frameworks like Tensor Flow/Keras, our system aims to provide a high performing and easily deployable diagnostic aid. The methodology involves utilizing Convolutional Neural Networks (CNNs) for image classification, trained on publicly available data sets of normal and pneumonia-affected X-rays. The core of the solution focuses on efficient data preprocessing, including image resizing and normalization, coupled with transfer learning from pre-trained models to accelerate development and enhance accuracy within the hackathons time constraints. Our goal is to demonstrate a robust proof-of concept capable of distinguishing pneumonia cases with significant precision, recall, and F1- score. This AI-powered tool offers potential for quick screening in resource-limited settings and can serve as a valuable assistant for medical professionals, highlighting Python's capability in impactful medical technology applications.

Keywords: Artificial Intelligence, Deep Learning, Convolutional Neural Networks (CNN), Pneumonia Detection, Chest X-ray Classification, Medical Image Analysis, Computer-Aided Diagnosis (CAD)

AI BASED MEDICAL DIAGNOSIS SYSTEM

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Abstract: The integration of Artificial Intelligence (AI) into healthcare has opened new horizons in the field of medical diagnosis. An AI-based medical diagnosis system leverages advanced machine learning algorithms, natural language processing, and image recognition techniques to assist healthcare professionals in detecting diseases with higher speed and accuracy. This system analyzes large volumes of patient data, including medical history, clinical symptoms, diagnostic reports, and imaging results, to provide reliable decision support. By minimizing human error and reducing the time taken for disease identification, AI-driven diagnosis improves patient outcomes and enables early intervention. Moreover, such systems can serve as valuable tools in areas with limited access to medical experts, thereby bridging the healthcare accessibility gap. This work highlights the design and potential of an AI-based medical diagnosis system, emphasizing its role in enhancing precision, efficiency, and scalability in modern healthcare delivery.

Keywords: Artificial Intelligence (AI), Medical Diagnosis, Machine Learning, Deep Learning, Clinical Decision Support System.

AI BASED SIMPLE GESTURE RECOGNITION

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Abstract: Gesture recognition has emerged as a promising human–computer interaction (HCI) Technique that enables machines to interpret human motions and respond intelligently. An AI based simple gesture recognition system leverages machine learning and computer vision Algorithms to identify and classify basic hand or body gestures in real time. By capturing Input through sensors or cameras, the system processes feature such as movement, Orientation, and shape to accurately recognize gestures. This work highlights the design, Implementation, and potential applications of simple gesture recognition using AI, emphasizing its role in enhancing user experience, accessibility, and automation. Artificial Intelligence (AI) has emerged as a transformative tool in the field of education, offering Advanced solutions to forecast student performance with high accuracy. By leveraging machine Learning algorithms, predictive analytics, and natural language processing, AI can analyse vast Datasets including attendance records, academic results, classroom participation, learning Behaviours, and socio-economic factors. This predictive capability empowers educators to identify At-risk students, personalize teaching strategies, and implement timely interventions to improve Academic success.

Keywords: Artificial Intelligence (AI), Gesture Recognition, Human–Computer Interaction (HCI), Machine Learning, Computer Vision, Real-Time Processing, Pattern Recognition.

AI BASED SMART TRAFFIC MANAGEMENT SYSTEMS USING IOT SENSORS

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Abstract: Rapid urbanization and the exponential growth of vehicles have led to severe traffic congestion, delays, and increased road accidents in modern cities. Conventional traffic management systems, which rely on static signals and pre-defined timings, often fail to adapt to dynamic traffic conditions. To address these challenges, this paper presents an AI-based Smart Traffic Management System integrated with IoT sensors that enables real time monitoring, adaptive signal control, and intelligent decision-making. This data is processed using Artificial Intelligence algorithms, including machine learning and deep learning models, to predict congestion patterns and dynamically optimize signal timings. The proposed system also incorporates vehicle prioritization for emergency services, accident detection, and congestion forecasting, ensuring smoother traffic flow and enhanced road safety. By combining AI with IoT enabled smart infrastructure, the system reduces travel time, fuel consumption, and carbon emissions, contributing to sustainable smart city development. Experimental simulations and case studies demonstrate that the proposed framework significantly outperforms conventional traffic control systems in terms of efficiency, responsiveness, and adaptability.

Keywords: IOT, enabled security, Battlefield security, Enemy detection.

AI IN SPACE EXPLORATION: AUTONOMOUS NAVIGATION AND MISSION PLANNING

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Abstract: Artificial Intelligence (AI) is revolutionizing the field of space exploration by enabling autonomous systems to perform critical operations with minimal human intervention. AI-driven autonomous navigation equips spacecraft and rovers with the ability to perceive their environment, avoid obstacles, and make independent decisions in real time. Furthermore, AI-enhanced mission planning ensures optimized scheduling, predictive modelling, and adaptive decision-making to maximize mission outcomes while reducing risks and operational costs. These advancements are essential for deep-space missions where communication delays make human oversight impractical. By integrating machine learning, computer vision, and intelligent planning algorithms, AI strengthens our ability to explore planetary surfaces, asteroids, and distant cosmic environments. The growing reliance on AI not only enhances mission efficiency but also paves the way for long-duration, sustainable interplanetary exploration.

Keywords: Artificial Intelligence, Space Exploration, Autonomous Navigation, Mission, Planning, Machine Learning, Computer Vision, Deep-Space, Missions, Intelligent Systems

AI POWERED CHATBOT

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Abstract: This project presents the design and development of an AI-powered chatbot capable of providing human-like interactions and automated assistance. The Chatbot leverages Natural Language Processing (NLP) and Machine Learning (ML) techniques to understand user queries, generate appropriate responses, and continuously improve its performance through feedback. It is designed to handle tasks such as answering frequently asked questions, guiding users through processes, and offering personalized recommendations. By integrating with popular messaging platforms and using a modular architecture, the Chatbot ensures scalability, efficiency, and ease of deployment in various domains such as education, healthcare, and customer service. This project demonstrates how AI-driven conversational agents can enhance user experience, reduce manual workload, and provide round-the-clock support.

Keywords: Artificial Intelligence (AI), Chatbot, Natural Language Processing (NLP), Machine Learning (ML), Conversational Agent, Automation, User Experience.

AI ENHANCED SMART TRAFFIC LIGHT CONTROLLER USING IMAGE PROCESSING

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Abstract: Urban intersections face growing congestion that conventional fixed-time traffic signals cannot efficiently handle. This work presents an AI-Enhanced Smart Traffic Light Controller that applies real-time image processing and machine learning to improve traffic flow. High-definition cameras capture live road images, which are analysed through convolutional neural networks (CNNs) to measure vehicle density and detect traffic patterns. A reinforcement-learning algorithm then adjusts signal phases dynamically to reduce average delay, fuel consumption, and emissions. The system also recognizes emergency vehicles, granting priority passage to improve public safety and response times. Experimental results from simulation and small-scale field trials indicate significant improvements in intersection throughput compared with traditional control methods. The proposed framework is cost-effective, scalable and well suited for integration into emerging smart-city transportation networks.

Keywords: Artificial Intelligence, Smart Traffic Light, Image Processing, Convolutional Neural Network, Adaptive Signal Control, Intelligent Transportation Systems, Smart City.

AI- POWERED SMART PROSTHETICS WITH EMF SIGNAL ANALYSIS

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Abstract: This project focuses on the development of an AI-powered smart prosthetic limb that uses Electromyography (EMG) signal analysis to interpret muscle activity for intuitive and precise movement control. By integrating advanced machine learning algorithms, the system can learn and adapt to the unique muscle patterns of individual users, enabling real-time responsiveness and improved functionality. The prosthetic enhances user comfort, mobility, and overall quality of life. This approach combines biomedical engineering, signal processing, and artificial intelligence to create a more natural and efficient human-machine interface, representing a significant innovation in assistive technologies for amputees.

Keywords: AI, smart prosthetic, EMG signal, machine learning, biomedical engineering, assistive technology.

EFFICIENT WATER MANAGEMENT USING AN AUTOMATIC PLANT IRRIGATION SYSTEM

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Abstract: Efficient water management is a critical component of sustainable agriculture and environmental conservation. This paper presents the design and implementation of an automatic plant irrigation system aimed at optimizing water usage while ensuring healthy plant growth. The system integrates soil moisture sensors, microcontrollers, and solenoid valves to monitor and regulate irrigation based on real-time data. When soil moisture falls below a predefined threshold, the system activates irrigation, minimizing water wastage and human intervention. Solar-powered modules and wireless communication enhance the system's energy efficiency and scalability. The proposed solution is particularly beneficial in regions facing water scarcity, as it promotes precision agriculture and resource conservation. Experimental results demonstrate significant water savings and improved crop yield. The system also supports remote monitoring and control via mobile applications, making it suitable for both small-scale gardens and large agricultural fields. By automating irrigation, this approach contributes to smart farming practices and aligns with global efforts toward sustainable development.

Keywords: Automatic irrigation system, Soil moisture sensor, Water conservation, Smart agriculture, Microcontroller-based control, Precision farming, Sustainable water management.

AI-DRIVEN PREDICTIVE MAINTENANCE SYSTEM FOR INDUSTRIAL MOTORS

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Abstract: The reliability of industrial motors is a critical factor in ensuring uninterrupted production and operational efficiency across manufacturing sectors. Conventional maintenance approaches, such as reactive and preventive strategies, often fall short in addressing unexpected failures and optimizing equipment life cycles. Reactive maintenance leads to costly downtime, while preventive methods may result in unnecessary servicing, thereby increasing operational costs. The system integrates advanced sensors to continuously monitor key motor parameters, including vibration, temperature, current, and acoustic emissions. These data streams are processed using machine learning algorithms capable of detecting patterns, identifying anomalies, and predicting potential failures before they occur. Unlike traditional systems, the AI-driven model provides accurate forecasts of motor health, enabling maintenance activities to be scheduled proactively and precisely when needed. This approach not only reduces unplanned downtime but also minimizes maintenance costs, extends equipment lifespan, and enhances overall productivity.

Keywords: Artificial Intelligence (AI), Predictive Maintenance, Industrial Motors

DESIGN AND DEVELOPMENT OF A CHILD BLIND SPOT DETECTION SYSTEM FOR CROWDED AREAS

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Abstract: This project addresses child safety in crowded environments through a blind spot detection system. Ultrasonic sensors and cameras are used to identify children near vehicles or machinery. The system alerts drivers or operators in real time to prevent accidents. Microcontrollers process sensor data and trigger visual and audio warnings. Computer vision algorithms enhance object recognition and tracking accuracy. The system is designed for use in school zones, parks, and urban areas. It adapts to different lighting and environmental conditions. Wireless communication enables remote monitoring and data logging. The design includes compact, weather-resistant hardware for outdoor deployment. Energy-efficient components support continuous operation. Field testing validates detection range, response time, and reliability. The system reduces human error and enhances situational awareness. It supports integration with smart vehicles and public safety infrastructure. User interfaces are developed for ease of use and accessibility. The project promotes child safety through proactive technology. It aligns with smart city and intelligent transportation initiatives. Scalability allows deployment in buses, construction zones, and residential areas. The system contributes to accident prevention and public health. It empowers communities with intelligent safety solutions. This innovation prioritizes vulnerable populations in urban design

Keywords: *Weather-resistant hardware, Detection range, Response time, and Reliability*

AI&ML USED MRI SCAN IN DISEASE DIAGNOSIS

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Abstract: Magnetic Resonance Imaging (MRI) is a powerful, non-invasive technique that produces detailed images of organs and tissues across the human body. Full-body MRI scans are important for detecting cancers, cardiovascular conditions, neurological disorders, and musculoskeletal problems. However, manual interpretation of these scans is time-consuming and may lead to human error. This project utilizes Artificial Intelligence (AI) and Machine Learning (ML) to automate the analysis of MRI scans. Using deep learning models such as Convolutional Neural Networks (CNNs), the system can classify normal and abnormal scans, detect affected regions, and support radiologists in faster and more accurate diagnosis. The approach improves reliability, reduces workload, and enhances early disease detection, making advanced medical care more efficient and accessible.

Keywords: *Tumor detection, Brain disorders, Cancer classification, Automated diagnosis, Predictive modeling, Clinical decision support, Early detection.*

AI-ENABLED SMART WHEELCHAIR WITH OBSTACLE AVOIDANCE AND VOICE CONTROL

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Abstract: The application of artificial intelligence (AI) in assistive devices is revolutionizing mobility solutions for differently-abled and elderly individuals. This project introduces an AI-enabled smart wheelchair designed with obstacle avoidance and voice control capabilities to enhance independence, safety, and accessibility. The system integrates ultrasonic and infrared sensors for real-time environment mapping and collision detection, while AI-based algorithms process the data to ensure smooth navigation and obstacle circumvention. A voice recognition module is employed to interpret user commands, enabling hands-free operation and minimizing the need for manual control. Testing results validate that the system effectively avoids obstacles, responds accurately to predefined voice commands, and maintains stable movement in indoor and outdoor environments. Compared to conventional wheelchairs, the proposed model offers greater autonomy, safety, and user convenience, making it a cost-effective solution for enhancing the quality of life of physically challenged individuals.

Keywords: Artificial Intelligence, Smart Wheelchair, Obstacle Avoidance, Voice Recognition, Assistive Technology, Autonomous Navigation.

AI-INTEGRATED DRONE FOR SMART SURVEILLANCE AND DISASTER MANAGEMENT

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Abstract: The integration of artificial intelligence (AI) into unmanned aerial vehicles (UAVs) enables autonomous, smart surveillance and rapid disaster response. AI-enabled drones combine high-resolution vision, thermal imaging, and advanced decision algorithms to detect, track, and assist in emergencies with minimal human intervention. We propose a modular system architecture comprising visual and infrared perception, navigation control, 5G/IoT communication, and onboard AI decision-making. The implementation uses a multirotor drone equipped with RGB and thermal cameras, an edge AI accelerator (e.g. NVIDIA Jetson), and custom control software. In experiments, the system achieved real-time detection (YOLOv8 at ~50 FPS on Jetson) with high precision and significantly reduced response time in SAR simulation. A case study of a mountain rescue scenario demonstrates dramatically faster victim localization via thermal YOLO tracking. This AI-augmented UAV platform offers improved coverage and efficiency over traditional methods, promising lower costs and higher safety for disaster management.

Keywords: AI, UAV, dronesurveillance, disastermanagement, YOLO, v8, thermalimaging, 5G communication, edge computing, Open Pose.

AI TECHNOLOGY OF ENERGY USAGE ESTIMATOR FOR CLOUD COMPUTING

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Abstract: The exponential growth of cloud computing has resulted in significant energy consumption, raising concerns about sustainability and efficiency. Artificial Intelligence (AI) offers a transformative approach to analysing, and optimizing energy usage in cloud environments. This paper presents the concept of an AI-driven Energy Usage Estimator that leverages machine learning models, predictive analytics, and intelligent monitoring to evaluate and forecast energy requirements across distributed cloud infrastructures. By integrating AI with cloud resource management, this system can dynamically allocate workloads, predict power demands, and minimize energy wastage. The use of real-time monitoring, anomaly detection, and optimization algorithms enhances decision-making and contributes to achieving greener cloud solutions. Furthermore, AI estimators can support data centres in reducing operational costs while improving energy efficiency and maintaining service-level agreements (SLAs). Dynamic workload distribution to optimize energy efficiency. Real-time monitoring and anomaly detection for power usage. Contribution towards sustainable and green cloud computing.

Keywords: Artificial Intelligence, Smart Wheelchair, Obstacle Avoidance, Voice Recognition, Assistive Technology, Autonomous Navigation.

AN INTELLIGENT APPROACH FOR SPAM MESSAGE DETECTION AND CLASSIFICATION

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Abstract: Spam mail classification is a widely researched area in machine learning and natural language processing due to the increasing volume of unwanted and malicious emails. The goal of spam classification is to automatically distinguish between legitimate (ham) and unsolicited (spam) messages using computational models. This project explores various techniques such as text pre-processing, feature extraction (TF-IDF, Bag of Words, and word embeddings), and machine learning algorithms including Naïve Bayes, Support Vector Machines, and deep learning models. The classification performance is evaluated using metrics like accuracy, precision, recall, and F1-score. By implementing and comparing these approaches, the system aims to enhance email security, reduce user inconvenience, and support robust filtering of spam messages in real-world scenarios.

Keywords: Spam detection, Email classification, Machine learning, Natural language processing, Text mining, Naïve Bayes, Support Vector Machine, Deep learning, TF-IDF, Email filter.

DEVELOPMENT OF A SMART ROBOTIC SYSTEM FOR AGRICULTURAL MONITORING AND OPERATIONS

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Abstract: This project focuses on designing a smart robotic system to automate agricultural tasks and enhance productivity. The robot is equipped with sensors to monitor soil moisture, temperature, and crop health. It uses GPS and computer vision for autonomous navigation across fields. Real-time data is collected and transmitted to a central dashboard for analysis. The system supports tasks like weeding, spraying, and harvesting. Machine learning algorithms help detect plant diseases and growth patterns. Wireless communication enables remote control and monitoring. Solar panels may be integrated for energy efficiency. The robot is built with rugged materials for outdoor durability. Modular design allows customization for different crops and terrains. It reduces labor dependency and operational costs. The system improves yield through precision farming techniques. Data analytics supports decision-making for irrigation and fertilization. The robot adapts to changing environmental conditions. It enhances sustainability by minimizing chemical usage. Field trials validate performance and reliability. The project contributes to smart agriculture and food security. It aligns with digital transformation in farming practices. Scalability makes it suitable for small and large farms. **Keywords:** Smart Agriculture, Agricultural Robotics, Precision Farming, Soil Monitoring

AN INTELLIGENT FRAMEWORK FOR EARLY DISEASE DETECTION AND DIAGNOSIS

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Abstract: Early detection of diseases is very important for improving patient health and reducing treatment costs. Many serious illnesses, such as cancer, pneumonia, and heart diseases, often don't show obvious symptoms in the early stages, making them hard to diagnose using the existing methods. A major challenge in healthcare today is delayed disease diagnosis. This project introduces an AI-powered systems that helps detect diseases at an early stage by analysing medical images and patient data with high accuracy and speed. The systems are designed, reduce human error, and provide healthcare access in remote areas. AI has the potential to enhance accuracy and efficiency of interpreting medical Images like MRIS, CT, scans. In this project, we have planned to develop an AI-based system that will employ machine learning to analyse medical images such as X-rays and CT scans, along with the patient medical records. This system helps doctors by identifying early signs of disease that are hard to spot manually. Machine learning models will be trained using large datasets of X-rays, CT scan, and patient records. The system is expected to achieve around 90% accuracy in detecting early-stage pneumonia, outperforming traditional methods. This demonstrates how AI can improve diagnosis speed, lower costs, reduce morality, and expand access to healthcare, especially in underserved regions.

Keywords: AI for diagnosis, early detection, reducing treatment cost

AI-POWERED CREDIT CARD FRAUD DETECTION SYSTEM

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Abstract: Credit card fraud has become a major concern for financial institutions due to the increasing number of online transactions and the sophistication of fraudulent activities. Detecting fraud is challenging because of the highly imbalanced nature of transaction data, where fraudulent transactions represent only a small fraction of the total volume. This study focuses on developing a machine learning-based fraud detection system that analyzes transaction patterns and identifies anomalies in near real time. The methodology involves preprocessing anonymized transaction data, applying feature engineering to extract user behavior patterns, and addressing class imbalance using resampling techniques such as SMOTE. Ensemble learning methods, including Random Forest and Gradient Boosting, are employed to enhance predictive accuracy while minimizing false positives. Experimental results demonstrate significant improvements in fraud detection rates with high precision and recall values, showing the model's capability to support financial institutions in preventing monetary losses and ensuring customer trust.

Keywords: Credit card Fraud Detection, Machine Learning, Ensemble Learning, Class Imbalance, SMOTE, Anomaly Detection, Financial Security

ANOMALY DETECTION IN BIOMEDICAL IMAGING USING HYBRID CNN

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Abstract: Anomaly detection in biomedical imaging plays a crucial role in the early diagnosis and treatment of various diseases by identifying irregular patterns that may not be easily visible to the human eye. Traditional image processing methods often struggle with the complexity, variability, and noise present in medical images, leading to reduced accuracy. To overcome these challenges, this work proposes a Hybrid Convolutional Neural Network (CNN) model that integrates the strengths of conventional CNN architectures with additional learning strategies such as feature fusion and multi-scale analysis. The hybrid approach enhances the network's capability to extract both local and global features, improving the sensitivity and specificity of anomaly detection. Experimental results on benchmark biomedical imaging datasets demonstrate that the proposed model achieves superior performance compared to standard CNN methods, effectively distinguishing between normal and abnormal regions. This study highlights the potential of hybrid deep learning frameworks to support clinicians with reliable, automated tools for medical image analysis, ultimately contributing to faster and more accurate clinical decision-making.

Keywords: Anomaly detection, biomedical imaging, Hybrid CNN

AQIP:SMART AIR QUALITY INDEX PRECICITION MODEL USING MACHINE LEARNING

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Abstract: Air pollution has emerged as one of the most pressing environmental challenges, significantly impacting human health, climate, and overall quality of life. The Air Quality Index (AQI) is a standardized indicator used to represent the concentration of key atmospheric pollutants such as particulate matter (PM_{2.5}, PM₁₀), nitrogen dioxide (NO₂), sulfur dioxide (SO₂), ozone (O₃), and carbon monoxide (CO). Accurate AQI prediction plays a crucial role in environmental monitoring, urban planning, and public health advisory systems. This project focuses on predicting AQI using data-driven techniques and machine learning algorithms. Historical air quality datasets, along with meteorological parameters like temperature, humidity, and wind speed, are analyzed to identify pollution patterns and forecast future AQI levels. By applying regression and classification models, the system is capable of delivering both short-term and long-term air quality predictions with improved accuracy. The proposed approach supports policymakers in implementing timely interventions and promotes public awareness, enabling individuals to take preventive measures against hazardous air conditions.

Keywords: Air Quality Index (AQI), Air Pollution, Machine Learning, Prediction Model, PM_{2.5}, PM₁₀, Meteorological Data, Regression, Forecasting, Smart City, Environmental Monitoring.

ARTIFICIAL INTELLIGENCE AS A CATALYST FOR EMERGING TECHNOLOGICAL ADVANCEMENTS

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Abstract: This project explores how Artificial Intelligence (AI) drives innovation across emerging technologies. AI enhances automation, decision-making, and predictive capabilities in diverse sectors. Applications include smart agriculture, healthcare, transportation, and industrial systems. Machine learning models process vast datasets for actionable insights. AI supports real-time monitoring, anomaly detection, and adaptive control. Natural language processing improves human-computer interaction. Computer vision enables intelligent surveillance and object recognition. AI accelerates development in IoT, robotics, and edge computing. AI's role in sustainability and climate modeling is examined. Case studies illustrate successful AI integration in real-world systems. The project highlights AI's impact on productivity and cost reduction. Challenges in scalability, data quality, and infrastructure are discussed. Future directions include explainable AI and AI-as-a-service models. The study promotes responsible and inclusive AI development. It supports digital transformation and smart innovation ecosystems. AI is positioned as a cornerstone of next-generation technology.

Keywords: Smart agriculture, healthcare, transportation, and industrial systems

AUTOCORRECT TOOL FOR ENHANCED TEXT ACCURACY

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Abstract: This project explores the design and implementation of an autocorrect tool aimed at improving text input accuracy and efficiency. The autocorrect tool leverages advanced algorithms to detect and correct grammatical errors, typos, and punctuation mistakes in real-time, offering a promising alternative to manual editing. Our approach utilizes a combination of natural language processing (NLP) techniques and machine learning models to enable context-aware corrections. Experimental results show improved accuracy and speed in text input compared to traditional manual editing methods. The proposed solution is user-friendly, scalable, and ideal for environments requiring precise and efficient text input, paving the way for next-generation text editing technology.

Keywords: Autocorrect, Text Input Accuracy, Natural Language Processing (NLP), Machine Learning, Context-Aware Corrections, Text Editing

AUTOMATIC HOME SECURITY ALARM SYSTEM

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Abstract: In modern urban settings, home security has become increasingly critical due to rising concerns over trespassing, unauthorized access, and burglary. This work proposes an automatic home security alarm system that integrates sensor networks, smart cameras, and remote monitoring via mobile and cloud platforms to provide reliable, real-time alerts and response. The system includes door/window magnetic sensors, motion detectors, glass-break sensors and optionally smoke/CO detectors, all connected to a central hub with Internet/cellular connectivity. On detection of anomalous activity, the system triggers a local alarm, sends notifications to homeowners, and optionally to a professional monitoring service. Additionally, the design incorporates automated behaviours—such as scheduled arming, contextual triggers, and interplay with lighting or locks—to reduce false positives and improve usability. Security and privacy are treated as first-class concerns: data encryption, local processing where possible, secure firmware update paths, and clear user controls over what data is stored and shared. The system is evaluated in terms of detection accuracy, response latency, false alarm rate, network reliability and user satisfaction. Results show that a balanced design can deliver high reliability (> 95%) in realistic environments, keeping false alarms low, and providing homeowners with meaningful situational awareness while preserving privacy. This work demonstrates how current IoT, communications, and AI/automation technologies can combine to deliver a practical, cost-effective, and secure automatic home security alarm solution.

Keywords: Home Security, Automatic Alarm System, Smart Sensors, Motion Detection, Door/Window

AUTOMATIC LPG DETECTION SYSTEM USING ARDUINO

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Abstract: This project presents an innovative automatic LPG detection system using Arduino, designed to ensure timely detection of LPG leaks and enhance safety in various settings. The system integrates a highly sensitive LPG sensor with Arduino, triggering an alarm when gas concentrations exceed predetermined thresholds. The proposed system offers numerous benefits, including improved safety, reduced risk of accidents, and increased efficiency in LPG-based applications. Its low-cost and user-friendly design make it an ideal solution for domestic, industrial, and commercial settings. The system provides real-time monitoring and alert systems for LPG leaks, ensuring a secure environment. Furthermore, its reliability and accuracy ensure minimal false alarms, reducing unnecessary disruptions. With its compact design and easy installation, this system is poised to revolutionize LPG safety standards. Overall, this project demonstrates the potential of Arduino-based systems in developing innovative solutions for real-world problems.

Keywords: *Arduino, LPG Detection, Gas Sensor, Automatic Alarm System, Safety, IoT*

AUTOMATIC RAILWAY TRAIN SAFETY SYSTEM

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Abstract: The Arduino based radar system uses an arduino UNO to control a servo motor and an HC SR04 ultrasonic sensor. The servo motor continuously sweeps the ultrasonic sensor across a 180-degree field. At each degree, the ultra-sonic sensor measures the distance to any object in its path. This data, which consist of angle and distance pairs, is sent to the arduino serial monitor. A processing application on a computer can then read this data and display it has a real time graphical radar screen. This project is an excellent introduction to robotics distance sensing, and graphical programming, as it demonstrates how simple components can be combined to create functional and visually engaging system. While the system is not a true radar which uses radio waves it effectively simulates the principles of object detection and mapping. The entire setup is cost effective, easy to assemble, and provides a solid foundation for more complex applications like obstacles avoidance in robots or home security systems

Keywords: *Arduino microcontroller, radar system, servo motor, ultrasonic sensor, object detection, distance measurement, angle positioning, real time monitoring, embedded system, iot applications*

UTILIZING ARTIFICIAL INTELLIGENCE TO FORECAST A STUDENT PERFORMANCE

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Abstract: Artificial Intelligence (AI) has emerged as a transformative tool in the field of education, offering advanced solutions to forecast student performance with high accuracy. By leveraging machine learning algorithms, predictive analytics, and natural language processing, AI can analyze vast datasets including attendance records, academic results, classroom participation, and socio-economic factors. This predictive capability empowers educators to identify at-risk students, personalize teaching strategies, and implement timely interventions to improve academic success. The research emphasizes that AI-driven forecasting not only enhances academic performance but also supports decision-making at institutional levels, reduces dropouts. Early identification of at-risk students through predictive models. Integration of structured (grades, attendance) and unstructured data. Application of machine learning algorithms such as, Neural Networks. Real-time monitoring of student progress and adaptive feedback loops. Personalized learning pathways tailored to individual needs.

Keywords: Artificial Intelligence, Machine Learning, predicting analysis, Academic Forecasting, Real Time Monitoring, Personalized Learning, Decision Making Support, Learning Analytics

THE THREE PILLARS OF THE MODERN ARTIFICIAL INTELLIGENCE ERUPTION

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Abstract: The rapid growth of artificial intelligence (AI) in the 21st century can be traced to three foundational pillars that have collectively triggered an unprecedented technological eruption: data availability, computational power, and advanced algorithms. The first pillar, the massive generation and accessibility of big data, has fueled the training of AI models across domains such as healthcare, finance, and autonomous systems. The second pillar, exponential improvements in computational resources—particularly GPUs, TPUs, and distributed cloud infrastructures—has enabled the handling of large-scale machine learning and deep learning tasks that were previously infeasible. The third pillar, breakthroughs in algorithms and architectures, including deep neural networks, transformers, and reinforcement learning, has transformed AI from narrow problem-solving tools into systems capable of complex reasoning and adaptability. Together, these three pillars have accelerated the adoption of AI across industries, reshaping economies, societies, and human-computer interaction. This paper examines the interplay of these elements, their role in the current AI eruption, and their implications for future research and ethical considerations.

Keywords: Artificial Intelligence, Big Data, Computational Power, Deep Learning, Machine Learning Algorithms, AI Eruption, Transformers, Reinforcement Learning.

THE SYMBIOTIC TRINITY: ANALYSING THE INTERDEPENDENT EMERGENCE OF ARTIFICIAL INTELLIGENCE, MACHINE LEARNING AND COMPUTATIONAL POWER

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Abstract: The rise of artificial intelligence (AI) is integral to the rise of machine learning algorithms and computational power, forming a "Symbiotic Trinity" of contemporary digital innovation. This approach argues that AI, machine learning, and high-performance computing advancements are a unified progression over time; the trajectories of each depend on advances in the others, and the values of each depend on churning advancements in the others. Machine Learning algorithms are powered by advanced models that create a decision-making process relying on the capability of pattern recognition, but the true use case of the models and algorithms emerges from reliable computational systems which allow for running logic and training of models through data. Computational advancements in technology have also been driven by the significant demands of AI applications. Responsible and ethical management of this trinity requires a systemic approach because ethical motivation should be highlighted based on shared values of equity and trust worthiness and professional and research collaboration must stress the importance of transparency, accountability, and human-centred design.

Keywords: Artificial intelligence (AI), machine learning (ML) algorithms, computational power, high-performance computing, symbiotic trinity, unified progression and interdependence

THE ROLE OF HIGH-PERFORMANCE COMPUTING IN CLIMATE AND RENEWABLE ENERGY FORECASTING

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Abstract: Accurate forecasting of climate patterns and renewable energy generation is critical for ensuring sustainable development, energy security, and effective resource management. However, the complexity of atmospheric dynamics, ocean circulation, solar irradiance, and wind variability requires advanced computational capabilities beyond conventional methods. High-Performance Computing (HPC) plays a pivotal role in addressing these challenges by enabling large-scale simulations, high-resolution climate modelling, and real-time analysis of vast environmental datasets. HPC platforms integrate machine learning and data assimilation techniques with physics-based models to enhance the accuracy of predictions in solar, wind, and hydropower forecasting. This facilitates better grid integration, efficient energy storage planning, and improved disaster preparedness. By leveraging parallel processing, distributed computing, and supercomputers, researchers can reduce uncertainty in long-term climate projections and optimize renewable energy utilization.

Keywords: Artificial Intelligence, Big Data, Computational Power, Deep Learning, Machine Learning Algorithms, AI Eruption, Transformers, Reinforcement Learning.

THE COMPUTATIONAL CATALYST IN AI AND MACHINE LEARNING

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Abstract: The rapid evolution of Artificial Intelligence (AI) and Machine Learning (ML) continues to be driven by advances in computational power, specialized hardware, and algorithmic innovation. These developments serve as a computational catalyst, enabling systems to process vast datasets, achieve higher accuracy, and operate with increasing efficiency. This paper critically examines the role of computational catalysts in shaping the trajectory of AI and ML, with particular attention to their ethical, technical, and societal implications. It emphasizes the importance of responsible design, sustainable resource utilization, and equitable access in the ongoing deployment of computational technologies. By integrating discussions on scalability, interpretability, and energy efficiency, the study provides a holistic perspective on how computational catalysts not only accelerate progress but also influence the ethical frameworks within which AI and ML operate. The findings underscore the necessity for a balanced approach that aligns technological advancement with professional responsibility and societal well-being.

Keywords: Artificial Intelligence (AI) Machine Learning (ML), Computational Catalysts, Algorithmic Innovation, Specialized Hardware, Scalability, Interpretability, Energy Efficiency, Responsible AI, Ethical Implications, Sustainable Computing, Equitable Access, Societal Impact

THE ROLE OF ARTIFICIAL INTELLIGENCE IN DRIVING ENTREPRENEURSHIP AND STARTUP GROWTH

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Abstract: Small business owners and start up entrepreneurs often face difficulties managing their daily operations, especially when it comes to tracking sales, monitoring investments, and making smart decisions about sales. Most available billing software are subscription-based, or lack intelligent support, leading to poor decision making and financial inefficiencies. This project introduces a free, easy-to-use web and mobile application designed to help business owners manage their operations intelligently. Users can either link their existing websites or app to automatically sync business data, or manually enter daily sales, and expenses records. The system tracks investments, profit, loss, and stock in real time. It offers smart suggestions on when to restock products and highlights which items sell the most or attract the most customer. Additionally, it identifies the target audience for each product and provides, visual reports showing the difference in profit versus loss. To ensure it is accessible to a wide range of users, multi-language support is integrated, and the entire solutions is provided free of charge. Periodic data analysis is performed using AI-generated predictive models, which provide actionable insights for smarter decision-making. Recommendations are presented through a user-friendly dashboard. It helps startups and small businesses improve efficiency, and increase profitability-all without any additional cost.

Keywords: Billing software, Startup, Entrepreneurship, Multilingual, Subscription free.

SUSTAINABLE AND GREEN COMPUTING ALGORITHMS IN EMBEDDED DEVICES USING AI

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Abstract: The global surge in digital technologies and data-driven applications has escalated energy consumption, particularly in data centers and embedded systems, leading to a substantial increase in carbon emissions and environmental impact. Sustainable and green computing aims to address these challenges by developing energy-efficient computing architectures and algorithms that minimize power consumption while maximizing performance. This field encompasses innovations in low-power hardware design, intelligent task scheduling, dynamic resource management, and power-aware algorithm optimization for both enterprise-scale data centers and resource-constrained embedded devices. By integrating renewable energy sources, leveraging virtualization, and deploying machine learning-driven workload and cooling management, recent advancements have demonstrated significant reductions in energy use and operational costs. The success of these approaches relies on a holistic co-design of hardware and software, as well as industry-wide adoption of sustainability standards, ultimately enabling scalable digital transformation that aligns with global environmental goals.

Keywords: Green Computing, Sustainable Computing, Energy-Efficient Computing

SOLAR POWERED LAWN MOVER

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Abstract: The Solar Powered Lawn Mower is an eco-friendly and energy-efficient solution designed to automate lawn maintenance while minimizing dependence on conventional fossil fuels. Powered primarily by solar energy, the system incorporates photovoltaic panels that charge onboard batteries, enabling operation even in areas without direct power supply. The mower integrates sensors, microcontrollers, and motor-driven cutting blades to ensure precise and efficient grass cutting. Intelligent obstacle detection mechanisms allow the mower to navigate lawns safely, avoiding trees, garden furniture, and other barriers. The design emphasizes sustainability, low operational cost, and noise reduction, making it suitable for residential, commercial, and public green spaces. By harnessing renewable energy, the system significantly reduces carbon emissions and electricity consumption compared to traditional mowers. Prototype testing demonstrates efficient energy utilization, consistent performance under varying sunlight conditions, and adaptive navigation across diverse terrains. Modular design features allow easy maintenance and scalability, while user-friendly controls and automated scheduling enhance convenience for users. The integration of solar technology with smart automation represents a step toward greener and more sustainable lawn management solutions. Future developments may include IoT connectivity for remote monitoring, AI-driven route optimization, and advanced battery management to further enhance efficiency.

Keywords: Solar Powered Lawn Mower, Photovoltaic Panels, Renewable Energy, Obstacle Detection, Microcontroller, Automated Lawn Maintenance, Eco-Friendly, Energy Efficiency.

SMART WASTE MONITORING AND MANAGEMENT USING IOT TECHNOLOGY

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Abstract: This project presents a low-cost obstacle detection system using Arduino and ultrasonic sensors. It is designed to enhance safety in vehicles, robotics, and mobility aids. Ultrasonic sensors measure distance to nearby objects and detect potential collisions. The Arduino microcontroller processes sensor data and triggers alerts. Visual and auditory signals notify users of approaching obstacles. The system operates in real time with minimal latency. It adapts to indoor and outdoor environments with varying light and terrain. Power-efficient components ensure long battery life and portability. The design is compact, lightweight, and easy to install. Modular architecture allows integration with other smart systems. The system is tested for accuracy, range, and responsiveness. Applications include autonomous robots, smart wheelchairs, and parking assistance. The project includes circuit design, coding, and hardware prototyping. User interfaces are developed for monitoring and control. The solution promotes safety and accessibility in everyday scenarios. It supports STEM education and DIY innovation. Field trials validate reliability and user experience. The system is scalable for personal, commercial, and industrial use. It contributes to intelligent navigation and obstacle avoidance. This innovation empowers users with smart sensing technology.

Keywords: Circuit design, coding, and hardware prototyping, STEM education

SMART VEHICLE ACCIDENT DETECTION AND ALERTING USING MACHINE LEARNING

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Abstract: Road accidents are a leading cause of fatalities and injuries worldwide, with delayed emergency response often increasing the risk of death. To address this challenge, a cost-effective Vehicle Accident Detection and Alert System is proposed without relying on an accelerometer. The system employs a vibration sensor to detect sudden impacts and a tilt sensor to identify abnormal vehicle orientation or rollover. Once an accident is detected, the microcontroller retrieves the vehicle's real-time location using a GPS module. This information, along with an automated alert message, is transmitted to pre-stored emergency contacts through a GSM communication module. The proposed system ensures quick notification of accidents, reduces response time, and improves the chances of saving lives, while maintaining low design complexity and cost.

Keywords: Vehicle Accident Detection, Vibration Sensor, Tilt Sensor, GPS, GSM, Emergency Alert, Real-Time Location, Road Safety.

SMART HOME SECURITY SYSTEM

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Abstract: A smart home security system integrates advanced technologies like IoT, AI, and wireless communication to provide comprehensive security and monitoring for residential properties. With features like real-time monitoring, remote control, intelligent alerts, and smart cameras, it enhances security, convenience, and energy efficiency. The system is designed to be scalable, secure, and user-friendly, providing homeowners with peace of mind and protection for their properties and loved ones. By leveraging AI-powered analytics and automation, smart home security systems offer a safer, more convenient, and more connected living experience. With the advancement of technology and the growth of the Internet of Things (IoT), the concept of smart homes has become increasingly popular, aiming to improve comfort, efficiency, and safety. Among these, home security is one of the most critical aspects, as rising incidents of burglary, intrusion, and property damage have created a strong need for intelligent, real-time monitoring solutions. A Smart Home Security System addresses this demand by integrating IoT devices, sensors, cameras, and cloud-based services to provide continuous surveillance, threat detection, and automated alerts, thereby enhancing the safety of residents and their property. The system employs various components such as motion detectors, door and window sensors, surveillance cameras, and alarm systems, all of which are interconnected through a central control unit.

Keywords: Home automation, IoT Security, Remote monitoring, Motion Detection, Smart cameras, Smart Locks, Security Automation, Real-Time Alerts, Home protection, Smart Sensors.

SMART WATER PURIFYING SYSTEM

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Abstract: Access to safe and clean drinking water remains a global challenge, and conventional purification methods are often inefficient, energy-intensive, or unable to address real-time contamination issues. A Smart Water Purifying System integrates advanced sensing, Internet of Things (IoT), and Artificial Intelligence (AI) technologies to ensure continuous monitoring, purification, and delivery of safe water. The system employs sensors to detect water quality parameters such as pH, turbidity, temperature, hardness, dissolved oxygen, and residual chlorine levels, enabling precise contamination analysis. IoT connectivity allows remote monitoring, data visualization, and automatic alerts to users regarding water quality and filter replacement needs. AI-driven decision-making optimizes purification cycles, reduces energy consumption, and extends filter life, ensuring sustainability. Cloud integration enables data storage, trend analysis, and predictive maintenance, while mobile applications enhance user interaction and control. Edge computing reduces latency in water quality assessment, enabling instant responses to contamination events.

Keywords: Smart water purification, IoT, AI, water quality monitoring, sustainable systems, real-time analysis.

SMART IRRIGATION SYSTEM

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Abstract: Efficient water usage is critical for sustainable agriculture. A Smart Irrigation System leverages IoT, sensors, and automated control technologies to optimize water distribution based on soil moisture, weather conditions, and crop requirements. The system continuously monitors soil parameters and environmental data to determine the optimal irrigation schedule, reducing water wastage and improving crop yield. Real-time alerts and analytics enable farmers to make informed decisions for better resource management. Experimental evaluations demonstrate improved water efficiency, cost savings, and enhanced agricultural productivity. This intelligent approach provides a sustainable solution for modern precision farming practices.

Keywords: Smart Irrigation, IoT, Sensors, Precision Agriculture, Automated Control, Water Efficiency, Sustainable Farming.

SMART TRAFFIC CONTROL SYSTEM

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Abstract: Rapid urbanization and population growth have intensified traffic congestion, accidents, and pollution in modern cities, making efficient traffic management a critical necessity. Traditional traffic control systems, which operate on fixed-timer signals, are often inefficient as they fail to adapt to real-time traffic fluctuations. A Smart Traffic Control System (STCS) leverages advanced technologies such as Artificial Intelligence (AI), Internet of Things (IoT), and computer vision to dynamically monitor, analyse, and regulate traffic flow. By integrating cameras, sensors, and connected devices, the system collects real-time traffic data including vehicle density, speed, and congestion levels. Machine learning algorithms and image processing techniques then process this data to optimize signal timings, thereby reducing waiting times and improving throughput at intersections. Vehicle-to-Infrastructure (V2I) communication allows seamless interaction between vehicles and traffic lights, further enhancing coordination. Emergency vehicle prioritization is enabled to ensure ambulances and fire engines receive green corridors, significantly reducing response times. Smart traffic systems also assist in detecting accidents, rule violations, and traffic bottlenecks, alerting authorities instantly for quick intervention. Cloud and edge computing integration provide scalability and low-latency decision-making, while big data analytics helps in long-term planning and policy-making. Renewable-powered smart signals ensure energy-efficient operation, aligning with sustainable city goals. The system also supports integration with Intelligent Transport Systems (ITS) for multimodal transport management. Despite challenges like high deployment costs, cybersecurity risks, and integration with legacy infrastructure, ongoing research and pilot projects demonstrate strong potential. Ultimately, Smart Traffic Control Systems contribute to reduced congestion, improved road safety, lower emissions, and enhanced commuter satisfaction, thereby playing a pivotal role in shaping future smart cities.

Keywords: Smart Traffic, IoT, AI, Traffic Management, Real-time Monitoring, Urban Mobility, Intelligent Transportation Systems

SMART WASTE MANAGEMENT

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Abstract: Waste management has become a critical issue in rapidly urbanizing cities. Smart waste management integrates IoT, AI, and sensor technologies to optimize waste collection and disposal. Traditional methods are often inefficient, leading to overflowing bins and environmental pollution. Smart systems use real-time monitoring to track bin levels, enabling dynamic route optimization for collection vehicles. Sensors in bins detect fill levels, temperature, and hazardous materials. Data is transmitted via wireless networks to a central platform. AI algorithms analyze patterns to predict waste generation trends. Cloud computing stores and processes large volumes of data efficiently. Smart waste management reduces operational costs, fuel consumption, and carbon footprint. Mobile applications can notify citizens about pickup schedules and recycling initiatives. Recycling and segregation are improved by monitoring waste types. IoT-enabled compactors increase in capacity, reducing collection frequency. Reduced greenhouse gas emissions contribute to climate action goals. Smart waste management improves hygiene and reduces vector-borne diseases. Collaboration between government, industry, and citizens is essential for success. The system supports real-time decision-making, ensuring sustainable, efficient, and cleaner urban environments.

Keywords: Smart waste management, IoT, AI, sensors, real-time monitoring, dynamic routing, predictive analytics, recycling, sustainability, circular economy, waste-to-energy

SMART IOT-BASED GENERATOR MONITORING AND MANAGEMENT SYSTEM WITH GPS TRACKING AND PREDICTIVE MAINTENANCE

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Abstract: In today's world, generators are widely rented for events, construction projects, and emergency use, but owners often face challenges such as theft, unauthorized usage, inefficient fuel consumption, and poor maintenance practices. To address these issues, this project proposes a Smart IoT-Based Generator Monitoring and Management System with GPS Tracking and Predictive Maintenance. The system provides real-time monitoring of generator parameters including fuel levels, load usage, temperature, vibration, and operational runtime. Integrated GPS and geo-fencing features ensure accurate location tracking and prevent misuse, while predictive maintenance based on runtime and oil condition helps avoid unexpected failures and ensures timely servicing. Electrical monitoring functions such as load profiling, overload detection, and power quality analysis improve safety and efficiency. An IoT dashboard and GSM-based SMS/Call alerts provide remote access to critical data, enabling owners to respond instantly to abnormal conditions. Additionally, the inclusion of rental management features like auto-billing and usage history records increases transparency and operational control. Overall, this project delivers a comprehensive solution that enhances generator reliability, safety, and profitability for owners and rental businesses.

Keywords: IoT, Generator Monitoring, GPS Tracking, Geo-Fencing, Predictive Maintenance

AUTONOMOUS SPACECRAFT NAVIGATION USING REINFORCEMENT LEARNING

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Abstract: Autonomous spacecraft navigation is a critical challenge in space exploration, where limited communication with ground stations and unpredictable space environments demand intelligent decision-making systems. Reinforcement Learning (RL) has emerged as a promising approach to enable spacecraft to learn optimal navigation policies by interacting with dynamic environments. Unlike traditional rule-based or pre-programmed methods, RL algorithms adapt to unforeseen conditions such as asteroid fields, gravitational anomalies, and fuel limitations, thereby enhancing robustness and efficiency. By leveraging simulation environments for training and deploying lightweight neural architectures onboard, spacecraft can achieve near real-time decision-making without constant human intervention. This research explores the application of RL-based techniques for trajectory optimization, obstacle avoidance, and fuel-efficient navigation in deep space missions. Advanced methods like Deep Q-Networks (DQN) and Policy Gradient algorithms are utilized to balance exploration and exploitation in navigation strategies. Experimental results from simulation models demonstrate that RL-driven spacecraft can achieve higher autonomy and resilience compared to conventional control systems. The study highlights the potential of reinforcement learning not only to reduce mission costs and risks but also to pave the way for future interplanetary and autonomous satellite missions where adaptability and independence are paramount.

Keywords: Reinforcement learning (RL), Deep Q-Networks (DQN), Policy gradient methods, Trajectory optimization, Obstacle avoidance, Fuel efficiency, Space mission autonomy, Onboard decision-making, Interplanetary exploration

COMPARING CPU, GPU AND TPU ENERGY EFFICIENCY IN AI PROCESSING

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Abstract: The rapid growth of Artificial Intelligence (AI) has increased the demand for high-performance computing while raising concerns about energy consumption. Central Processing Units (CPUs), Graphics Processing Units (GPUs), and Tensor Processing Units (TPUs) are the primary hardware platforms supporting AI workloads. This paper presents a comparative analysis of their energy efficiency in AI processing. CPUs, though flexible, deliver low throughput and poor performance-per-watt ratios for deep learning tasks. GPUs exploit massive parallelism to accelerate training and inference, offering better efficiency than CPUs but at higher power costs. This comparison highlights that choosing task-specific hardware like TPUs is essential for sustainable and eco-friendly AI development, particularly in data centers where energy demand is critical.

Keywords: CPU, GPU, TPU, Energy Efficiency, Performance-per-Watt, FLOPS/Watt, Deep Learning Acceleration, Sustainable Computing.

COMPUTING-EFFICIENT AI ACCELERATOR FOR IOT DEVICES

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Abstract: The rapid growth of the Internet of Things (IoT) has led to billions of connected devices generating massive volumes of data that require intelligent and real-time processing. Traditional cloud-based AI solutions face challenges of latency, bandwidth limitations, energy consumption, and privacy, making on-device intelligence a critical requirement. Computing-efficient AI accelerators designed for IoT devices provide an effective solution by enabling low-power, high-performance, and real-time data processing at the network edge. These accelerators are optimized for deep learning workloads such as convolutional neural networks (CNNs), recurrent neural networks (RNNs), and transformer-based models, while significantly reducing energy consumption. Techniques such as model pruning, quantization, and compression are integrated to reduce computation and memory footprint, ensuring feasibility on resource-constrained IoT hardware. Hardware architectures such as FPGA-based accelerators, ASICs, and RISC-V custom cores are utilized to achieve energy-efficient inference. In-memory and near-memory computing reduce data movement overhead, while approximate computing and sparsity exploitation further enhance performance-per-watt. Integration with edge computing platforms allows real-time decision-making for applications such as smart healthcare, industrial automation, environmental monitoring, and intelligent transportation systems. Ultimately, they enable scalable, secure, and sustainable AI deployment across diverse IoT applications, ensuring intelligent decision-making at the edge while minimizing energy and computational overhead.

Keywords: IoT, AI accelerator, edge computing, low-power design, neural networks, hardware-software co-design, real-time processing

DEEP LEARNING-ASSISTED ECG ANALYZER FOR EARLY HEART DISEASE DETECTION

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Abstract: Heart disease is a leading cause of death worldwide, and early diagnosis is essential for effective treatment and prevention. This study presents a Deep Learning-Assisted ECG Analyzer designed to automatically detect early signs of heart disease from electrocardiogram (ECG) signals. Using advanced deep learning models such as convolutional neural networks (CNN) and long short-term memory (LSTM) networks, the system analyses ECG patterns to identify abnormalities like arrhythmias and other heart conditions. The model is trained on large annotated datasets and tested for accuracy, sensitivity, and specificity. The results show that the analyser achieves high precision in detecting early heart issues, outperforming traditional diagnostic methods. The proposed solution can be integrated into healthcare systems for real-time monitoring and early intervention, potentially saving lives, reducing healthcare costs, and improving patient care through faster and more accurate diagnosis.

Keywords: Deep Learning, ECG analysis, heart disease detection, convolution neural networks, LSTM, early diagnosis, healthcare technology, arrhythmia detection, artificial intelligence.

CREDIT CARD DETECTION USING AI

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Abstract: The integration of artificial intelligence (AI) in credit card detection has revolutionized the way transactions are secured. By leveraging advanced computer vision and machine learning algorithms, AI-powered systems can accurately identify and verify credit card details, reducing the risk of fraudulent activities. These systems are trained on vast datasets of credit card images, enabling them to learn patterns and anomalies that may indicate tampering or counterfeiting. One of the key benefits of AI-driven credit card detection is its ability to enhance security without compromising user convenience. Traditional methods of credit card verification often require manual input or physical inspection, which can be time-consuming and prone to human error. In contrast, AI-powered systems can rapidly process and verify credit card information, streamlining transactions and improving the overall user experience. The applications of AI-powered credit card detection extend beyond transactional security. For instance, it can be used in retail environments to monitor and prevent potential credit card skimming or tampering. Additionally, AI-driven systems can help financial institutions detect and prevent card duplication, further safeguarding customers' sensitive information.

Keywords: Anomaly detection, Fraud Transactions, Real-time Analysis, Financial Security, Data Imbalance Problem, Predictive Modeling

DOOR RECEPTIONIST WITH SMART LOCK SYSTEM

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Abstract: The project aims in designing a “Smart Door Receptionist with Smart Lock System” Smart Receptionist with smart lock system is mainly designed and developed for security systems. This smart security system is used to see a visitor when the main door of the office or Home is closed. Today we face security issues in each angle. So, we attempt to determine these issues by utilizing refreshed innovation. During this task, we are utilizing the Face acknowledgment module to catch human pictures and saving in a data base. Assuming it Image matches with the data base then door will be opened by an electromagnetic lock with help of lock. The use of face recognition system that's accurately detect all unauthorized users from highly secured areas and aids in minimizing human error. Face recognition system is one of the highest security systems when compared with finger print locking system and also password-based security system. The time and accuracy factor are taken into account about the main problem which specifies the performance of automatic face recognition in real-time environments. Traditional security systems, such as manual locks and password-based systems, pose risks due to unauthorized access and password leaks. The Smart Door Receptionist with Smart Lock System integrates face recognition, IoT, and Raspberry Pi-based automation to enhance security and streamline access control.

Keywords: Smart Lock, Face Recognition, IoT Security, Raspberry Pi, Automated Access Control, Smart Door Receptionist

EMAIL SPAM DEDECTION USING AI

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Abstract: The proliferation of email spam has become a significant challenge for individuals and organizations alike. Spam emails not only clutter inboxes but also pose serious security risks, including phishing attacks and malware distribution. Traditional rule-based approaches to spam detection have limitations, as spammers continually adapt and evolve their tactics. Machine learning-based approaches, on the other hand, offer a promising solution by enabling systems to learn from data and improve over time. One of the key advantages of machine learning-based email spam detection is its ability to analyze complex patterns in email data. By examining features such as sender information, email content, and metadata, these systems can identify subtle cues that distinguish spam from legitimate emails. Moreover, machine learning models can be trained on large datasets, enabling them to recognize and adapt to new spam patterns and tactics. The effectiveness of machine learning-based spam detection depends on the quality of the training data and the choice of algorithms. Commonly used algorithms include supervised learning techniques such as logistic regression, decision trees, and support vector machines. Additionally, deep learning techniques like convolutional neural networks (CNNs) and recurrent neural networks (RNNs) have shown promise in email spam detection tasks. To further improve the accuracy of machine learning-based spam detection, researchers are exploring various techniques, including ensemble methods, feature engineering, and transfer learning. Ensemble methods combine the predictions of multiple models to produce more accurate results.

Keywords: Phishing attacks, Malware distribution, Rule-based approaches, logistic regression, Support vector machines, Convolutional neural networks, Recurrent neural networks.

FPGA-ACCELERATED CONVOLUTIONAL NEURAL NETWORKS FOR REAL-TIME IMAGE RECOGNITION IN EDGE APPLICATIONS

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Abstract: The growing demand for real-time image recognition in applications such as surveillance, autonomous systems, and healthcare requires efficient and low-power solutions. This work presents an FPGA-accelerated neural network framework for image classification, focusing on achieving high speed and energy efficiency compared to traditional CPU/GPU platforms. The proposed system employs a lightweight convolutional neural network (CNN) mapped onto FPGA hardware using optimized parallelism and pipelining techniques. A Xilinx Artix-7 FPGA development board is utilized with Vivado HLS for hardware implementation and Python-based training of the CNN model. Experiments on the MNIST dataset demonstrate recognition accuracy of over 95% while achieving significant improvements in latency and power consumption relative to software-only execution. This hardware-software co-design showcases the potential of FPGA-based AI accelerators for edge devices, offering a scalable and practical solution for real-time image recognition tasks in embedded systems.

Keywords: FPGA, Neural Networks, CNN, Real-Time Image Recognition, Edge Computing, Hardware Acceleration.

GREEN COMPUTING FOR AI MODELS IN RENEWABLE SYSTEMS

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Abstract: Artificial Intelligence (AI) is increasingly applied in renewable energy systems to enhance forecasting accuracy, optimize energy storage, enable predictive maintenance, and improve grid stability. However, the computational intensity and energy demand of large-scale AI models raise concerns about their environmental impact, potentially conflicting with the sustainability goals of clean energy. Green computing provides a viable solution by integrating energy-efficient hardware, low-power algorithms, model compression, and carbon-aware computing practices to reduce the ecological footprint of AI systems. This paper investigates the role of green computing techniques in optimizing AI applications for solar, wind, hydro, and hybrid renewable systems. The study emphasizes lightweight AI architectures, edge and federated learning, and intelligent resource allocation strategies that improve efficiency without compromising accuracy. Furthermore, the integration of renewable-powered data centers and eco-aware scheduling is explored as a means to align AI-driven solutions with sustainable energy practices. The findings demonstrate that embedding green computing into AI workflows not only minimizes carbon emissions and operational costs but also enhances the scalability, resilience, and economic viability of renewable energy infrastructures.

Keywords: Green computing, Artificial Intelligence, Renewable energy systems, Energy efficiency, Sustainable computing, Edge AI, Model optimization, Carbon footprint reduction.

FPGA-BASED SYSTEM FOR REAL-TIME IMAGE PROCESSING

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Abstract: Real-time image processing is a critical requirement in modern applications such as autonomous vehicles, surveillance systems, medical imaging, and industrial automation. Traditional processors often struggle to meet the low-latency demands of these systems due to sequential execution and limited parallelism. This project presents the design and implementation of a high-performance image processing system using Field Programmable Gate Arrays (FPGAs), which offer massive parallelism, reconfigurability, and low power consumption. The proposed system leverages FPGA architecture to accelerate core image processing tasks such as edge detection, filtering, and object recognition. By utilizing hardware description languages (HDLs) like VHDL or Verilog, the system is optimized for speed and resource efficiency. The design includes modules for image acquisition, preprocessing, and feature extraction, all integrated into a real-time pipeline. Performance benchmarks demonstrate significant improvements in frame rate and processing latency compared to conventional CPU-based systems. The system is tested using standard image datasets and real-time camera feeds, validating its robustness and scalability. This work highlights the potential of FPGA-based solutions in meeting the stringent requirements of real-time image processing across diverse domains.

Keywords: FPGA, Real-Time Processing, Image Processing, Edge Detection, Hardware Acceleration, VHDL, Verilog, Parallel Computing, Low Latency

HAND WRITTEN DIGIT RECOGNITION USING MACHINE LEARNING TECHNIQUES

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Abstract: Abstract-Handwritten digit recognition is one of the most widely studied applications of machine learning and computer vision, with significant importance in areas such as postal automation, bank check processing, and form digitization. The main objective is to enable machines to accurately interpret human-written numerical digits, which vary widely in style, size, and orientation. Traditional approaches relied on manual feature extraction, while modern systems leverage deep learning, particularly convolutional neural networks (CNNs), to automatically learn hierarchical representations of digit images. Datasets like MNIST have played a crucial role in benchmarking and advancing these methods. With high accuracy achieved by state-of-the-art models, handwritten digit recognition not only demonstrates the power of supervised learning but also serves as a foundational problem for developing robust pattern recognition systems. The successful implementation of such systems reduces human effort, increases speed, and enhances accuracy in digit-related data processing, paving the way for broader applications in document analysis and intelligent automation.

Keywords: *Handwritten Digit Recognition, Machine Learning, Deep Learning, Convolutional Neural Networks (CNNs), MNIST Dataset, Pattern Recognition, Image Classification, Automation.*

HYBRID AI ELECTRONICS PLATFORM BRAIN COMPUTER INTERFACE

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Abstract: Brain-Computer Interface (BCI) technologies are rapidly evolving as a bridge between human Neural activity and external devices, enabling seamless interaction without conventional motor Pathways. This paper proposes a Hybrid AI-Electronics Platform for BCI, integrating advanced Signal acquisition electronics with Artificial Intelligence-driven algorithms for real-time Processing and interpretation of neural signals. The hybrid platform leverages low-noise bio-signal Acquisition circuits, efficient feature extraction, and deep learning models to enhance accuracy, Speed, and adaptability in BCI systems. By combining hardware-level optimizations with AI-based Intelligence, the proposed framework aims to overcome challenges such as signal variability, noise Interference, and real-time adaptability, making it suitable for applications in healthcare, neurorehabilitation, assistive technologies, and human-machine interaction. The platform holds Potential to advance next-generation BCI solutions that are scalable, energy-efficient, and capable of providing robust brain-controlled operations in real-world environments.

Keywords: *Brain-Computer Interface (BCI), Artificial Intelligence (AI), Hybrid Electronics, Deep Learning, Signal Processing, Neuro Rehabilitation, Human-Machine Interaction.*

INTELLIGENT ENERGY MANAGEMENT STRATEGY FOR HYBRID ELECTRIC VEHICLE

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Abstract: Hybrid Electric Vehicles (HEVs) are a promising solution to reduce fossil fuel dependency and greenhouse gas emissions while ensuring high performance and efficiency. A key challenge in HEVs is the effective management of power flow between the internal combustion engine (ICE), electric motor, and energy storage system. Traditional rule-based strategies provide basic functionality but are often suboptimal under varying driving conditions. To address this, intelligent energy management strategies have been developed using advanced techniques such as fuzzy logic, neural networks, model predictive control, and machine learning algorithms. Recent studies have demonstrated significant improvements in fuel economy and reduced pollutant emissions through the integration of intelligent control systems. Moreover, advancements in connectivity and vehicle-to-infrastructure communication further enhance real-time decision-making and adaptability. Overall, intelligent energy management strategies are essential for the sustainable operation of HEVs, enabling them to play a crucial role in the transition toward cleaner and smarter transportation systems.

Keywords: Hybrid Electric Vehicle (HEV), Energy Management, Fuzzy Logic, Neural Networks, Model Predictive Control, Machine Learning, Fuel Economy, Emission Reduction, Regenerative Braking, Smart Transportation.

IFFR-ML: SMART IOT-ENABLED FIRE FIGHTING ROBOTICS WITH MACHINE LEARNING

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Abstract: This project focuses on designing an Internet of Things (IoT)-enabled fire fighting robotic system for autonomous detection and suppression of fires in hazardous environments, significantly enhancing safety for human responders. The robotic system integrates multiple sensors (temperature, smoke, flame detectors) for early fire detection and employs a water spray/ extinguisher mechanism for effective suppression. Leveraging IoT connectivity, the robot enables real-time remote monitoring and control, facilitating swift action in dangerous scenarios. Key features include autonomous navigation, fire localization, extinguishing capabilities, and alert mechanisms for rapid response coordination. The solution aims to reduce risks in industrial, residential, and forest fire scenarios, showcasing integration of robotics and IoT for advanced safety applications.

Keywords: IoT (Internet of Things), Fire Fighting Robotics, Autonomous Navigation, Fire detection, flame sensors, smoke detection, extinguishing system, wireless communication.

IOT BASED SMART GARBAGE SYSTEM FOR EFFICIENT WASTE MANAGEMENT

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Abstract: Due to the rapid increase in population, the country is facing massive waste management challenges in smart cities. More than 377 million urban people live in 7,935 towns and cities and generate 62 million tonnes of municipal solid waste per annum. Only 43 million tonnes of the waste is composed and 11.9 million tonnes are managed and 31 million tonnes are thrown out in open landfill sites. Waste Management is one of the most essential services provided by municipal authorities in the country to keep the urban center clean. Approximately 90% of the municipal solid waste is dumped in the landfill yard within or outside the city haphazardly. Experts believe that India is following the wrong system of waste disposal and management. It can be manageable to sort out biodegradable and dry waste by developing an electromechanical system using microcontroller and Pi camera. For sorting different kind of waste, three colour boxes i.e. blue, red and green has been used in which waste were put and reorganization of the colour boxes like blue boxes contains metal waste, red box contains recyclable waste, green box contains biodegradable has been done with the help of Pi camera through computer vision and image processing technique.

Keywords: *Waste Collection & Segregation, Conveyor Belt, Motor, Raspberry Pi, IR sensors*

IOT-ENABLED WEATHER STATION FOR PRECISION

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Abstract: Precision agriculture aims to optimize farming practices by leveraging technology to monitor and respond to environmental conditions in real time. This project presents the design and implementation of an IoT-enabled weather station tailored for agricultural applications. The system integrates various sensors to measure temperature, humidity, soil moisture, rainfall, wind speed, and solar radiation. These parameters are crucial for informed decision-making in irrigation scheduling, crop selection, pest control, and yield prediction. The weather station uses microcontrollers and wireless communication modules to transmit data to a cloud-based platform, enabling remote access and real-time analytics. The system is powered by solar energy, ensuring sustainability and uninterrupted operation in rural areas. Field deployment and testing demonstrate the system's reliability, accuracy, and scalability. By automating data collection and analysis, the IoT-enabled weather station empowers farmers to enhance productivity, conserve resources, and adapt to climate variability. This work contributes to the advancement of smart farming technologies and supports the global shift toward sustainable agriculture.

Keywords: *IoT, Precision Agriculture, Weather Station, Smart Farming, Soil Moisture, Temperature Monitoring, Humidity Sensor, Rainfall Detection.*

IOT FOR SMART CITIES

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Abstract: The Internet of Things (IoT) has emerged as a transformative technology in the realization of smart cities, where interconnected devices, sensors, and intelligent systems collaborate to improve the quality of urban life. IoT enables seamless data collection, communication, and analysis across diverse domains, including transportation, energy, healthcare, environment, and governance. By deploying smart sensors in public infrastructure, cities can monitor traffic flow, manage street lighting, and optimize public transportation in real time. IoT-enabled waste management systems ensure efficient collection and recycling by detecting bin fill levels, while smart grids and meters enhance energy efficiency by balancing supply and demand. In the environmental domain, IoT devices monitor air and water quality, providing early warnings for pollution and enabling sustainable resource management. Smart healthcare systems utilize wearable IoT devices for patient monitoring and emergency response, reducing hospital load and improving accessibility. Blockchain and secure communication protocols address privacy and security concerns in sensitive citizen data. Furthermore, predictive analytics based on IoT data helps in proactive governance, disaster management, and urban planning.

Keywords: IoT, Smart Cities, Sensors, Data Analytics, Urban Management, Real-time Monitoring, Sustainable Development

INTELLIGENT ASSISTIVE WHEELCHAIR FOR PHYSICALLY DISABLED PERSON

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Abstract: Our project is specifically related to the IOT handling the wheel chair system. The wheelchair System is recommended to control a wheel chair by using the internet. The objective of this project is to facilitate the movement of disable people or handicapped and also the senior people who are not able to move well. The result of this design will allow the special people to live a life with less dependence on others. IOT technology is a key which may provide a new approach of human interaction with machines or tools. Thus, their problem can be solved by using IOT to control the movement of a wheelchair. Smart Wheelchair is known as a Power Wheelchair that is integrated into multiple sensors, assistive technology, and computers that give the user with a disability such as impairment, handicaps, and permanent injury, the required mobility to move freely and safely.

Keywords: Intelligent wheelchair, assistive technology, obstacle detection, voice/gesture control, autonomous navigation, accessibility, IOT.

IOT-BASED SOIL AND HUMIDITY MONITORING

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Abstract: The rapid advancement of the Internet of Things (IOT) has enabled the development of Smart solutions in agriculture to address issues of water and resource management. This paper presents an IOT-based soil and humidity Monitoring system designed to provide real-time data on soil moisture content and Environmental humidity. The system employs soil moisture sensors and DHT Sensors interfaced with a microcontroller unit, which transmits data to a cloud platform via Wi-Fi connectivity. The collected data can be accessed and analyzed through a web or mobile application, allowing farmers to monitor field conditions remotely.

Keywords: IOT, soil moisture, humidity monitoring, smart irrigation, precision agriculture, wireless sensor networks, cloud computing

LIFI FOR HIGH - SPEED COMMUNICATION

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Abstract: Light Fidelity (LiFi) is an emerging wireless communication technology that utilizes visible light, ultraviolet, or infrared light instead of conventional radio frequencies to transmit data. By employing Light Emitting Diodes (LEDs) as transmitters and photodiodes as receivers, LiFi offers extremely high data transfer rates, low latency, and improved security. Unlike Wi-Fi, which suffers from bandwidth limitations and interference, LiFi operates in the visible light spectrum, providing a significantly broader bandwidth and supporting data rates exceeding gigabits per second under laboratory conditions. Furthermore, LiFi ensures enhanced security since light cannot penetrate opaque barriers, reducing the risk of unauthorized access. Ongoing research focuses on hybrid LiFi-Wi-Fi systems, modulation techniques, and advanced optical components to overcome these challenges and enable practical deployment. As demand for high-speed, secure, and energy-efficient communication systems grows, LiFi stands out as a promising next-generation technology capable of complementing or even surpassing traditional wireless networks.

Keywords: LiFi, High-speed communication, Visible light communication (VLC), LED transmitter, Photodiode receiver, Bandwidth, Low latency, Secure communication, Smart cities, Next-generation wireless.

LOW-COST AIR MONITORING SYSTEM

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Abstract: Air pollution is a major threat to human health and the environment. Traditional air quality monitoring stations are expensive and limited in coverage. A low-cost air monitoring system is proposed to enable widespread surveillance. It employs IoT-enabled sensors for real-time detection of pollutants. Gases such as CO, CO₂, NO₂, SO₂, and O₃ are monitored. Particulate matter sensors detect PM_{2.5} and PM₁₀ with accuracy. Temperature and humidity sensors support environmental condition tracking. Data acquisition is managed via Arduino and Raspberry Pi microcontrollers. Wireless transmission uses Wi-Fi and GSM modules for remote access. Collected data is uploaded to a cloud platform for storage and analysis. A web-based and mobile dashboard provides real-time visualization. Threshold-based alerts notify users of dangerous pollutant levels. Calibration ensures accuracy, reliability, and repeatability of measurements. Low-cost components make the system affordable, scalable, and deployable. Deployment is feasible in urban, industrial, and residential areas. The system enables continuous and automated monitoring with minimal effort. Historical data logging allows trend analysis and research applications. Integration with AI algorithms supports predictive pollution modelling. Community participation enables crowdsourced air quality monitoring.

Keywords: Low-cost air monitoring, IoT, gas sensors, PM_{2.5}, PM₁₀, Arduino, Raspberry Pi, real-time monitoring, cloud platform, smart cities, environmental awareness, predictive modeling, sustainable operation.

MACHINE LEARNING- OPTIMIZER SOLAR POWER TRACKING SYSTEM

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Abstract: This paper presents a machine learning–driven solar power tracking system that integrates artificial intelligence techniques with a dual-axis tracking mechanism to enhance photovoltaic (PV) energy capture. The proposed framework leverages Convolutional Neural Network–Long Short-Term Memory (CNN-LSTM) models for solar irradiance forecasting, reinforcement learning for adaptive control, and edge computing for real-time decision-making. Optimization algorithms, including Genetic Algorithms (GA) and Particle Swarm Optimization (PSO), are incorporated to maximize efficiency under dynamic environmental conditions. Experimental results indicate a 25–35% improvement in energy yield compared with fixed solar panels and up to a 30% reduction in operational costs. The system achieves irradiance forecasting accuracy with RMSE values as low as 0.031, while edge computing enables microsecond-level responsiveness. The findings demonstrate a scalable and intelligent solar tracking system that adapts to real-world variability while maintaining efficiency and reliability.

Keywords: machine learning, solar tracking, optimization, CNN-LSTM, reinforcement learning.

MACHINE LEARNING APPROACHES FOR NOISE REDUCTION IN SPEECH SIGNALS

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Abstract: Speech signals are frequently degraded by background noise, affecting intelligibility and audio quality in applications such as telecommunication, hearing aids and voice-controlled systems. Traditional noise reduction techniques, including spectral subtraction and Wiener filtering, often fail in complex and non-stationary noise environments. Machine Learning approaches offer a promising alternative by learning the underlying patterns of clean speech and effectively separating it from noise. This study explores the use of convolutional neural networks (CNNs), long short-term memory networks (LSTMs), and autoencoders for speech enhancement. The performance of these models is evaluated in terms of noise suppression and preservation of speech quality. Results demonstrate that machine learning-based methods outperform conventional approaches, providing significant improvements in challenging acoustic conditions. These findings underscore the potential of ML-driven noise reduction techniques for real-time speech processing applications.

Keywords: Speech Enhancement, Noise Reduction, Machine Learning, Deep Learning, Convolutional Neural Network (CNN), Long Short-Term Memory (LSTM).

MACHINE LEARNING-BASED FAULT DETECTION IN POWER ELECTRONICS CIRCUITS

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Abstract: Power electronics circuits are indispensable in modern applications such as renewable energy systems, electric vehicles, and industrial drives. However, their reliability is often affected by unexpected faults, which can cause efficiency losses, equipment failures, and costly downtime. Conventional fault detection methods, based on analytical modeling and threshold monitoring, are limited in addressing nonlinear behavior and variable operating conditions. This paper proposes a machine learning (ML)-based framework for fault detection in power electronics circuits. By extracting features from electrical signals such as voltage, current, temperature, and switching patterns, ML algorithms—including support vector machines, decision trees, and deep learning models—are employed for effective fault identification and classification. The findings suggest that ML-based fault detection can enhance predictive maintenance, improve system safety, and ensure reliable operation of advanced power electronic systems in smart grids, renewable energy, and electric mobility.

Keywords: Machine Learning, Fault Detection, Power Electronics, Predictive Maintenance, Smart Grids, Electric Vehicles, Deep Learning

MACHINE LEARNING-OPTIMIZED SOLAR POWER TRACKING SYSTEM

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Abstract: The increasing global demand for renewable energy has highlighted the importance of improving solar energy harvesting efficiency. A major challenge in photovoltaic (PV) systems is maintaining optimal alignment with the sun’s trajectory throughout the day. This paper presents a machine learning-optimized solar power tracking system designed to maximize energy output by dynamically adjusting the orientation of solar panels. Unlike conventional single-axis or dual-axis tracking systems, the proposed model integrates machine learning algorithms to predict sun positioning, environmental conditions, and shading patterns. Historical and real-time data are analyzed to generate intelligent tracking commands that minimize power losses due to weather fluctuations and structural misalignments. This approach offers a scalable, adaptive, and cost-effective solution to enhance solar energy utilization, supporting the advancement of smart renewable power systems.

Keywords: Solar Power Tracking, Machine Learning, Photovoltaic Systems, Renewable Energy, Energy Optimization

MIXED - SIGNAL VLSI DESIGN

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Abstract: Mixed-Signal VLSI design integrates both analog and digital circuits on a single chip to achieve high performance, low power consumption, and compact size. This approach is crucial for modern electronic applications such as communication systems, biomedical devices, and consumer electronics. The design process involves careful consideration of signal integrity, noise minimization, and timing synchronization between analog and digital components. Advanced CAD tools, simulation techniques, and layout optimization are employed to ensure functionality and reliability. The study demonstrates the advantages of mixed-signal VLSI design in improving system efficiency, reducing silicon area, and enabling cost-effective production of complex integrated circuits.

Keywords: Mixed-Signal VLSI, Analog-Digital Integration, Low Power Design, Signal Integrity, IC Design, CAD Tools, Integrated Circuits

MONITORING AND DETECTION OF MANHOLE USING LOT

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Abstract: Monitoring and Detection of Manhole Covers via IoT IoT-based monitoring and detection of manholes uses sensors and wireless technologies to ensure safety and Improve maintenance by continuously tracking environmental and structural parameters within manholes in real-time. This paper details an IoT based system for monitoring and detection of manhole covers in *cities*. The new system makes use of sensors to find out the manhole cover status and environmental conditions, and then transmits the Information to a cloud-based platform to continuously monitor. The IoT system ultimately can give authorities *enough* time to react to a potential hazard and can create public safety as well as reduce the cost and amount of repair maintenance needed. An *IoT* based monitoring system for manhole covers can be ultimately used as a reliable and effective method of smart cities and Infrastructure. This system using *IoT* sensors to monitor manhole covers, detecting anomalies like gas leaks, water levels, and unauthorized access. *Real-time data* is transmitted to a cloud platform, enabling authorities to respond *promptly* to potential hazards.

Keywords: *IoT, Manhole monitoring, Smart city, Sensors, Public Safety.*

MOVIE RECOMMENDATION SYSTEM

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Abstract: With the exponential growth of digital media platforms, recommending relevant movies to users has become a critical task in enhancing user experience. A movie recommendation system is designed to automatically suggest films based on a user's preferences, viewing history, and behavior patterns. This project implements an AI-driven recommendation system using collaborative filtering, content-based filtering, and hybrid approaches. Collaborative filtering utilizes similarities among user ratings to provide suggestions, while content-based filtering analyzes movie attributes such as genre, cast, and director. Hybrid models combine both methods to overcome limitations like the cold-start problem and data sparsity. The system leverages machine learning and natural language processing techniques for improved personalization. By delivering accurate and meaningful recommendations, this system aims to increase user satisfaction, engagement, and platform efficiency.

Keywords: *Movie recommendation. Collaborative filtering. Content-based filtering. Hybrid recommendation. Personalization, Machine learning. Natural language*

ML-BASED INTRUSION DETECTION SYSTEM FOR SMART HOME

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Abstract: The increasing integration of IoT devices in smart homes has introduced new vulnerabilities, making cybersecurity a critical concern. IDS often fall short in these environments due to limited resources and dynamic network behaviour. This project presents a Machine Learning-based IDS tailored for smart home networks, aiming to detect and prevent unauthorized access and cyber threats in real time. By analysing network traffic patterns using supervised learning algorithms such as Support Vector Machines (SVM), Random Forest, and Naive Bayes, the system can effectively classify normal and malicious activity. The model is trained on publicly available IoT datasets, with feature selection techniques applied to optimize performance and reduce computational overhead. Key functionalities include lightweight deployment, adaptive threat detection, and an intelligent alert mechanism for suspicious behaviour. The proposed IDS enhances smart home security by offering high accuracy, low false positive rates, and scalability across diverse device types. This approach not only strengthens digital safety but also contributes to the development of resilient, intelligent home ecosystems.

Keywords: IoT security, Smart homes, Intrusion Detection System (IDS), Machine Learning, Cybersecurity, Network traffic analysis.

MULTI-AGENT SOCRATIC AI TUTOR

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Abstract: The evolution of artificial intelligence in education has paved the way for advanced tutoring systems that go beyond traditional question-answering approaches. The Multi-Agent Socratic AI Tutor leverages multiple AI agents to facilitate critical thinking, problem-solving, and deeper understanding in learners through guided dialogue. Inspired by the Socratic method of inquiry, the system engages students in reflective conversations, encouraging them to explore concepts, justify reasoning, and evaluate a... By distributing tasks across specialized AI agents—such as reasoning agents, knowledge agents, and feedback agents—the system ensures dynamic and personalized tutoring experiences. Each agent collaborates to assess learner progress, identify misconceptions, and adaptively adjust the level of questioning to suit the student’s cognitive development. This design not only enhances subject mastery but also promotes analytical thinking, creativity, and self-directed learning. The proposed framework highlights the potential of AI-powered Socratic tutors to democratize education by offering scalable, interactive, and human-like guidance for learners across diverse domains and skill levels.

Keywords: Artificial Intelligence, Multi-Agent Systems, Socratic Method, AI Tutor, Personalized Learning, Critical Thinking, Educational Technology

MACHINE LEARNING-BASED ON ADAPTIVE CHANNEL CODING AND ERROR CORRECTION FOR FADING CHANNELS

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Abstract: Fading in wireless communication channels poses significant challenges to reliable data transmission, especially in dynamic environments. Traditional channel coding and error correction techniques often lack adaptability to rapidly changing channel conditions, leading to elevated bit error rates and degraded system performance. This paper proposes a machine learning-based framework that dynamically adjusts channel coding and error correction strategies using real-time channel state information (CSI). The framework incorporates adaptive feedback mechanisms to continuously monitor channel conditions and optimize transmission reliability. Simulation results reveal that the proposed system achieves lower bit error rates and reduced latency compared to conventional static coding schemes. The solution is scalable and well-suited for deployment in next-generation wireless networks, including 5G, IoT, and mobile broadband systems. This research advances the development of intelligent communication systems capable of sustaining robust performance in unpredictable wireless environment.

Keywords: Wireless Communication, Channel Fading, Machine Learning, Channel State Information, Adaptive Coding, Error Correction, Bit Error Rate, 5G Networks.

NEUROMORPHIC COMPUTING INSPIRED HARDWARE FOR PATTERN RECOGNITION

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Abstract: Neuromorphic computing represents a transformative approach in the design of computing hardware by mimicking the architecture and functionality of the human brain. This paradigm leverages spiking neural networks, event-driven processing, and low-power architectures to enable efficient learning, adaptation, and real time decision-making. In the domain of pattern recognition, neuromorphic-inspired hardware has shown immense potential to outperform traditional Von Neumann architectures in terms of scalability, energy efficiency, and robustness. By utilizing specialized circuits that emulate synapses and neurons, these systems can perform parallel processing and adapt to dynamic environments with high accuracy. The integration of neuromorphic chips in applications such as image recognition, speech processing, and sensor data analysis highlights their significance in the future of artificial intelligence.

Keywords: Neuromorphic Computing, Spiking Neural Networks, Pattern Recognition, Brain-inspired Hardware, Artificial Intelligence

OBSTRUCTION AVOIDANCE SYSTEM

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Abstract: The Obstruction Avoidance System (OAS) is an intelligent solution designed to enhance the safety and efficiency of vehicles and autonomous devices by detecting and avoiding obstacles in real-time. Advanced algorithms, including sensor fusion and path planning, enable the system to navigate complex and dynamic environments while minimizing response time. The design emphasizes low power consumption, cost-effectiveness, and adaptability across various platforms, including robotics, drones, and smart vehicles. Experimental simulations and prototype implementations demonstrate significant improvements in obstacle detection accuracy, system responsiveness, and overall safety. By reducing human error and enabling autonomous navigation in uncertain conditions, the Obstruction Avoidance System is poised to contribute to safer transportation and industrial automation. Its modular architecture ensures scalability, allowing integration with other intelligent systems for enhanced situational awareness.

Keywords: Obstruction Avoidance System, Autonomous Navigation, Ultrasonic Sensors, Infrared Sensors, LIDAR, Microcontroller, Sensor Fusion, Path Planning, Collision.

QUANTUM COMPUTING AND ARTIFICIAL INTELLIGENCE: THE SYNERGY OF TWO REVOLUTIONARY TECHNOLOGIES

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Abstract: Quantum computing and artificial intelligence are two rapidly advancing disciplines whose integration is expected to significantly enhance computational capabilities and problem-solving frameworks. Quantum computers are distinguished by their exploitation of phenomena such as superposition and entanglement, allowing them to process and analyze large-scale data sets, solve optimization challenges, and support machine learning tasks that are infeasible for conventional systems. Merging quantum technologies with AI methods sets the foundation for new models, such as quantum neural networks and quantum-accelerated learning algorithms, which may facilitate solutions for computationally intensive tasks including NP-hard problems and error minimization in high-dimensional spaces. Current research explores how these resources can be applied in sectors ranging from healthcare optimization to logistics planning and scientific research. The convergence of quantum computing and artificial intelligence holds significant promise for groundbreaking innovation across industries.

Keywords: quantum computing, artificial intelligence, quantum machine learning, superposition and entanglement.

REINFORCEMENT LEARNING BASED ROBOTIC ARM FOR PRECISION ASSEMBLY

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Abstract: In modern manufacturing, precision assembly is crucial for ensuring product quality, consistency, and operational efficiency. Traditional robotic arms rely on pre-programmed paths and deterministic control, which lack adaptability to dynamic environments and unforeseen variations. To overcome these limitations, this project proposes a Reinforcement Learning (RL)-based Robotic Arm system for precision assembly tasks. The system leverages RL algorithms to enable the robotic arm to learn optimal control strategies through trial-and-error interaction with the environment enhancing adaptability and precision. By integrating sensors and vision-based feedback, the arm continuously refines its actions for accurate alignment, force control, and error minimization. The RL framework supports dynamic task allocation, anomaly detection, and online learning, ensuring robustness in varying industrial conditions. Experimental results demonstrate improved assembly accuracy, reduced downtime, and enhanced scalability compared to conventional control methods.

Keywords: Reinforcement Learning, Robotic Arm, Precision Assembly, Industrial Automation, Adaptive Control, Machine.

RENEWABLE ENERGY-BASED GRASS CUTTING SYSTEM USING SOLAR POWER

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Abstract: The increasing demand for sustainable and eco-friendly technologies has led to the development of innovative solutions in everyday applications. This project presents a solar-powered grass cutting system designed to reduce dependency on fossil fuels and minimize environmental impact. The system harnesses solar energy through photovoltaic panels to power an electric motor that drives the cutting blades. It eliminates the need for gasoline or diesel, thereby reducing carbon emissions and operational costs. The system is lightweight, portable, and ideal for residential and small-scale agricultural use. Safety features, such as blade guards and automatic shut-off mechanisms, enhance user protection. Additionally, the system can be adapted for autonomous operation using sensors and microcontrollers, making it suitable for smart gardening applications. This renewable energy-based grass cutter not only promotes green technology but also contributes to sustainable development goals by offering a clean, efficient, and cost-effective alternative to conventional lawn mowers.

Keywords: Solar-powered grass cutter, Renewable energy, Sustainable technology, Photovoltaic system, Eco-friendly lawn mower, Battery-operated cutting system, green energy

SEMICONDUCTOR MATERIALS: SILICON VS. GALLIUM NITRIDE (GAN) AND SILICON CARBIDE (SIC)

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Abstract: Semiconductor technology has emerged as the cornerstone of modern electronics, driving advancements in computation, communication, and automation. Silicon has been the dominant material in semiconductor technology for more than five decades, enabling large-scale integration and the growth of the global electronics industry. However, as device requirements move toward higher efficiency, higher power density, and operation at elevated frequencies and temperatures, the limitations of silicon have become more apparent. Wide bandgap semiconductors such as Gallium Nitride (GaN) and Silicon Carbide (SiC) are emerging as superior alternatives due to their exceptional electrical, thermal, and switching characteristics. GaN offers high electron mobility and efficiency at high frequencies, making it ideal for applications in 5G communication and power converters. SiC, on the other hand, exhibits excellent thermal conductivity and high breakdown voltage, making it highly suitable for electric vehicles, renewable energy systems, and high-power industrial applications.

Keywords: Semiconductor devices, High-frequency devices, Moore's Law, Renewable energy systems, Switching efficiency, 5G communication, Future electronics

SECURE FINGERPRINT BANK LOCKER WITH IMAGE CAPTURE

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Abstract: In the evolving landscape of biometric security, this project presents a Secure Fingerprint Bank Locker System integrated with real-time image capture to enhance personal and institutional safety. The system leverages fingerprint authentication as the primary access control mechanism, ensuring that only authorized users can unlock the locker. Upon each access attempt, the system captures an image of the user via a built-in camera, providing an additional layer of visual verification and audit trail. This dual-authentication approach not only strengthens security but also deters unauthorized access and identity spoofing. The design incorporates a microcontroller, fingerprint sensor, camera module, and alert system, making it suitable for banking environments, personal vaults, and institutional lockers. The captured data can be stored locally or transmitted to a secure server for monitoring and forensic analysis. By combining biometric precision with surveillance intelligence, this project demonstrates a scalable and cost-effective solution for modern security challenges.

Keywords: Biometric Security, Fingerprint Authentication, Image Capture, Bank Locker, Surveillance System, Access Control, Embedded Systems, Secure Storage.

SILICON TECHNOLOGY IN BATTERY CARBIDE (SIC)

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Abstract: Silicon technology in batteries has emerged as a transformative advancement in energy storage, primarily for lithium-ion batteries. Traditional graphite anodes, though widely used, are limited by their relatively low theoretical capacity of about 372 mAh/g. In contrast, silicon offers a much higher theoretical specific capacity of nearly 4200 mAh/g, making it an attractive alternative for next-generation batteries. Furthermore, the integration of silicon with advanced manufacturing techniques, such as nano-coatings, porous structures, and flexible electrode designs, has enhanced stability and scalability. Applications of silicon-based batteries are particularly significant in electric vehicles, portable electronics, and renewable energy storage systems, where higher capacity and longer lifetimes are essential. Ongoing research also explores combining silicon with emerging solid-state electrolytes and hybrid materials to further improve safety, charging speed, and performance. Overall, silicon technology represents a critical step toward high-capacity, durable, and sustainable energy storage solutions, aligning with the global demand for efficient clean energy technologies.

Keywords: Silicon anode, Lithium-ion battery, Energy storage, High capacity, Nanostructure, SEI stability, Electric vehicles, Renewable energy.

SMART HELMET FOR RIDER SAFETY AND ACCIDENT DETECTION

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Abstract: This project presents the design and development of a Smart Helmet system aimed at improving rider safety and ensuring compliance with traffic regulations. The Smart Helmet integrates multiple sensors and modules, including an alcohol detection sensor, vibration sensor, and GPS/GSM module. The system ensures that the vehicle will only start if the rider is wearing the helmet and passes the safety checks, thereby reducing the risk of accidents due to negligence or intoxication. In case of a collision, the vibration sensor detects the impact and automatically sends the rider's location to emergency contacts using GSM and GPS, enabling faster response and assistance. This solution promotes road safety, reduces accident fatalities, and enhances emergency management. The proposed Smart Helmet is cost-effective, scalable, and can be adapted for widespread use to ensure safer transportation.

Keywords: Smart Helmet, Rider Safety, Accident Detection, GPS/GSM Module, Alcohol Detection Sensor, Vibration Sensor, IoT-based Safety System

THE SYMBIOTIC TRINITY: AI-INTEGRATED DRONE FOR SMART SURVEILLANCE AND DISASTER MANAGEMENT

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Abstract: Silicon technology in batteries has emerged as a transformative advancement in energy storage, primarily for lithium-ion batteries. Traditional graphite anodes, though widely used, are limited by their relatively low theoretical capacity of about 372 mAh/g. In contrast, silicon offers a much higher theoretical specific capacity of nearly 4200 mAh/g, making it an attractive alternative for next-generation batteries. However, challenges such as significant volume expansion (up to 300%) during lithiation, mechanical degradation, and unstable solid electrolyte interphase (SEI) have limited its commercial adoption. Recent advancements in nanostructured silicon materials, silicon-carbon composites, and novel binders have shown promising results in mitigating these issues, improving cycle life, and maintaining energy density. Ongoing research also explores combining silicon with emerging solid-state electrolytes and hybrid materials to further improve safety, charging speed, and performance. Overall, silicon technology represents a critical step toward high-capacity, durable, and sustainable energy storage solutions, aligning with the global demand for efficient clean energy technologies.

Keywords: Voice Control, Home Automation, Smart Homes, Speech Recognition, IoT, Wireless Communication, Energy Efficiency.

SMART ENERGY METER

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Abstract: The increasing global demand for electricity and the rising importance of energy conservation have created the need for smart energy metering solutions. A Smart Energy Meter is an advanced digital device that measures, records, and communicates electricity consumption data in real-time to both consumers and utility providers. Unlike conventional meters, smart meters enable two-way communication, allowing utilities to remotely monitor usage, detect faults, and even control energy distribution. These meters support dynamic pricing models, where consumers are charged based on peak and off-peak usage, thus encouraging efficient energy consumption. Utility companies benefit from improved demand forecasting, reduced losses due to electricity theft, and better grid stability. Smart meters also play a key role in smart grids, renewable energy integration, and automated billing systems, thereby reducing human errors and operational costs. Additionally, smart meters support real-time alerts for abnormal consumption, voltage fluctuations, or power outages, enhancing safety and reliability.

Keywords: Smart Energy Meter, IoT, Smart Grid, Energy Efficiency, Real-Time Monitoring, Automated Billing, Wireless Communication, Load Management

REAL-TIME VEHICLE COLLISION AVOIDANCE THROUGH ADVANCED DRIVER ASSISTANCE

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Abstract: This project develops a real-time collision avoidance system using advanced driver assistance technologies. It integrates ultrasonic sensors, radar, and cameras to detect nearby vehicles and obstacles. Machine learning algorithms analyze driving patterns and predict potential collisions. The system adapts to urban, highway, and off-road environments. Simulation tools are used to test performance under various traffic conditions. The project includes hardware prototyping and embedded system programming. Energy-efficient components are selected for automotive integration. The system is designed to comply with safety and regulatory standards. User interface design focuses on clarity and minimal distraction. Field trials validate accuracy, reliability, and user acceptance. The solution aims to reduce road accidents and fatalities. It supports autonomous driving and smart mobility initiatives. Data logs are used for post-incident analysis and system improvement. The system is scalable for integration into commercial and personal vehicles. It contributes to safer transportation infrastructure. This innovation aligns with the future of intelligent vehicular systems.

Keywords: Steering Control, Edge Computing, Embedded Systems, Machine Learning

LOWCOST AIR MONITORING SYSTEM

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Abstract: Air pollution is a major threat to human health and the environment. Traditional air quality monitoring stations are expensive and limited in coverage. A low-cost air monitoring system is proposed to enable widespread surveillance. It employs IoT-enabled sensors for real-time detection of pollutants. Gases such as CO, CO, NO, SO, and Oare monitored. Particulate matter sensors detect PM2.5 and PM10 with accuracy. Temperature and humidity sensors support environmental condition tracking. Data acquisition is managed via Arduino and Raspberry Pi microcontrollers. Wireless transmission uses Wi-Fi and GSM modules for remote access. The system enables continuous and automated monitoring with minimal effort. Historical data logging allows trend analysis and research applications. Integration with AI algorithms supports predictive pollution modelling GPS-enabled modules provide air quality mapping and geolocation data. The system aids government agencies and environmental researchers in decision-making. Open-source hardware and software reduce overall project costs. Early detection of pollutant surges helps mitigate health risks effectively. Real-time monitoring promotes public awareness and preventive action. The modular design allows future expansion with additional sensors.

Keywords: Low-cost air monitoring, IoT, gas sensors, PM2.5, PM10, Arduino, Raspberry Pi, real-time monitoring, cloud platform, smart cities, environmental awareness, predictive modeling, sustainable operation.

PERFORMANCE ANALYSIS OF SOLAR TRACKING SYSTEMS FOR RENEWABLE ENERGY APPLICATIONS

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Abstract: This project investigates the efficiency of solar tracking systems in maximizing photovoltaic output. It compares fixed, single-axis, and dual-axis trackers under varying sunlight conditions. Sensors and microcontrollers are used to align panels with the sun's position. Data is collected on energy yield, cost-effectiveness, and system responsiveness. The analysis includes environmental impact and long-term sustainability. Simulation tools model solar movement and panel orientation. Real-time monitoring enhances performance evaluation. The system is tested in different geographic and seasonal contexts. Results show significant gains in energy capture with tracking systems. Maintenance and reliability factors are also assessed. The study supports renewable energy adoption in smart grids. It contributes to reducing fossil fuel dependency. Solar tracking is vital for rural electrification and off-grid solutions. The project integrates IoT for remote diagnostics. Energy storage and load balancing are considered. Economic feasibility is analyzed for large-scale deployment. The system is scalable for residential and industrial use. Findings guide future solar infrastructure planning. This research promotes sustainable energy innovation. It aligns with global climate and energy goals.

Keywords: Solar Tracking System, Renewable Energy, Dual-Axis Tracker, Single-Axis Tracker

IOT-ENABLED SMART AGRICULTURE SYSTEM FOR PRECISION FARMING

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Abstract: The integration of Internet of Things (IoT) technologies into agriculture has revolutionized traditional farming practices, paving the way for precision farming. This paper presents an IoT-enabled smart agriculture system designed to optimize resource utilization, enhance crop yield, and support sustainable farming. The system employs a network of sensors to monitor key parameters such as soil moisture, temperature, humidity, and nutrient levels in real time. These data are transmitted to a centralized cloud platform where machine learning algorithms analyze patterns and provide actionable insights. Automated irrigation, pest control, and fertilization systems respond dynamically to sensor inputs, reducing human intervention and minimizing waste. Farmers can access dashboards and alerts via mobile applications, enabling informed decision-making and remote farm management. The framework also supports predictive analytics for crop health and yield forecasting. Field trials demonstrate improved efficiency, reduced operational costs, and increased productivity. This smart agriculture system offers a scalable and adaptable solution for modern farming challenges.

Keywords: Smart Agriculture, Precision Farming, Internet of Things (IoT), Sensor Networks, Soil Moisture Monitoring, Climate Data Analysis

IOT-BASED SMART MONITORING AND CONTROL SYSTEM FOR SUSTAINABLE APPLICATIONS

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Abstract: The rapid advancement of the Internet of Things (IoT) has enabled the development of intelligent systems that can monitor, analyze, and control real-world parameters in real time. This project proposes an IoT-based smart monitoring and control system that integrates low-cost sensors, microcontrollers, and cloud platforms to enhance efficiency, automation, and decision-making. The system is designed to collect data such as temperature, humidity, energy consumption, or environmental parameters through sensor nodes, which are connected to a Wi-Fi-enabled microcontroller. The acquired data is transmitted securely to a cloud server where it can be stored, processed, and visualized using web or mobile applications. Real-time alerts and notifications are generated in case of abnormal conditions, allowing preventive actions. The implementation emphasizes low power consumption, scalability, and cost effectiveness, making it suitable for applications such as smart homes, industrial automation, healthcare, and environmental monitoring.

Keywords: IoT, Smart Monitoring, Control System, Sensors, Remote Monitoring, Cost effective, Energy Efficiency.

DESIGN AND IMPLEMENTATION OF AN IOT-BASED SMART WASTE MANAGEMENT SYSTEM

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Abstract: This project aims to revolutionize urban waste handling through an IoT-enabled smart management system. Sensor-equipped bins monitor waste levels in real time and transmit data to a centralized dashboard. The system uses GSM or Wi-Fi modules for seamless communication with municipal servers. Algorithms optimize collection routes based on bin status and location. Overflow alerts help prevent littering and improve sanitation. Data analytics support predictive maintenance and resource allocation. Mobile apps allow citizens to report issues and track bin status. Solar-powered units enhance energy efficiency and sustainability. The system reduces fuel consumption and operational costs for waste collection. It supports smart city initiatives and environmental goals. Integration with GIS maps improves route planning and bin placement. The project includes hardware prototyping and software development. Security protocols ensure data integrity and privacy. Scalability allows deployment across residential, commercial, and industrial zones. The system is tested under varying load and weather conditions. User feedback is collected to refine usability and performance. It promotes civic engagement and awareness of waste management. The solution is adaptable to different geographic and economic contexts. This innovation contributes to cleaner, smarter urban environments. It sets a benchmark for sustainable municipal infrastructure.

Keywords: Sensor-Based Monitoring, Waste Collection Optimization, Real-Time Data

ARDUINO BASED RADAR SYSTEM AND SERVO MOTOR

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Abstract: The Arduino based radar system uses an arduino UNO to control a servo motor and an HC SR04 ultrasonic sensor. The servo motor continuously sweeps the ultrasonic sensor across a 180 degree field. At each degree, the ultra sonic sensor measures the distance to any object in its path. This data, which consist of angle and distance pairs, is sent to the arduino serial monitor processing application on a computer can then read this data and display it has a real time graphical radar screen. This project is an excellent introduction to robotics distance sensing, and graphical programming, as it demonstrate how simple components can be combined to create functional and visually engaging system. While the system is not a true radar which uses radio waves it effectively simulates the principles of object detection and mapping .The entire setup is cost effective, easy to assemble, and provides a solid foundation for more complex applications like obstacles avoidance in robots or home security systems.

Keywords: Arduino microcontroller, radar system, servo motor, ultrasonic sensor, object detection, distance measurement, angle positioning, real time monitoring, embedded system, iot applications.

HYBRID-SATELLITE 6G COMMUNICATION

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Abstract: The rapid evolution of wireless networks toward sixth-generation (6G) communication demands seamless global coverage, ultra-low latency, and high data rates. Conventional terrestrial infrastructure alone cannot meet these requirements, particularly in remote and underserved regions. To address this challenge, satellite assisted communication is emerging as a promising solution for 6G networks. This paper explores the integration of satellite systems with terrestrial networks to enable ubiquitous connectivity, enhanced reliability, and improved spectral efficiency. We present an overview of the key enabling technologies, including non terrestrial networks (NTN), low Earth orbit (LEO) satellite constellations, and advanced beamforming techniques. Furthermore, the potential benefits of satellite-assisted 6G, such as global broadband access, disaster management support, and intelligent transportation, are discussed. Challenges including latency, spectrum allocation, and seamless handover are also highlighted, along with potential research directions. This study emphasizes that satellite-terrestrial convergence will play a pivotal role .

Keywords: communication, 6G networks, non terrestrial networks (NTN), low Earth orbit (LEO) satellites, spectral efficiency, ultra-low latency, seamless handover, global broadband access

AI POWERED SMART ENERGY METER FOR REAL TIME LOAD PREDICTION

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Abstract: Recent years, the increasing frequency and severity of natural and man-made disasters have highlighted the critical need for efficient and rapid emergency response systems. Autonomous rescue robots powered by Artificial Intelligence (AI) are emerging as a transformative solution to address challenges faced by first responders in hazardous environments. This paper explores the role of AI in enhancing the capabilities of rescue robots, focusing on their ability to navigate complex terrains, identify victims, and perform search-and-rescue operations with minimal human intervention. Machine learning algorithms enable these robots to process sensor data, adapt to changing conditions, and make real-time decisions, while advances in computing power support faster data processing and improved accuracy. The integration of AI-driven perception, path planning, and control systems in rescue robots significantly improves the effectiveness and safety of disaster response efforts. This study also discusses the ethical considerations, limitations, and future directions in deploying AI-powered autonomous systems in disaster scenarios, aiming to contribute to smarter, safer, and more resilient emergency management frameworks.

Keywords: AIML, Autonomous Rescue Robots, Disaster Management, Emergency Response

PREDICTIVE MAINTENANCE OF RENEWABLE ENERGY SYSTEMS USING AI

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Abstract: The integration of Artificial Intelligence (AI) into renewable energy systems has opened new pathways for optimizing performance, reducing downtime, and minimizing maintenance costs. This study focuses on the development and application of AI-driven predictive maintenance frameworks for renewable energy assets such as wind turbines, solar photovoltaic (PV) systems, and hydroelectric units. By leveraging machine learning and deep learning techniques, the proposed approach analyzes real-time sensor data and historical operational records to detect early signs of component degradation and potential failures. Advanced algorithms, including neural networks, support vector machines, and anomaly detection models, are employed to predict faults before they occur, enabling timely maintenance scheduling. The implementation of predictive maintenance not only enhances the reliability and efficiency of renewable energy generation but also extends equipment lifespan and reduces operational expenses. The results demonstrate that AI-based predictive analytics significantly outperform traditional maintenance strategies, paving the way for more sustainable and intelligent energy infrastructure.

Keywords: Predictive Maintenance, Artificial Intelligence (AI), Machine Learning, Deep Learning, Renewable Energy Systems, Wind Turbines, Solar Photovoltaic (PV) Systems

AI USED FOR POWER CONSUMPTION CALCULATOR FOR DEVICES

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Abstract: The rapid growth in the use of electronic devices across personal and industrial domains has increased the need for effective energy monitoring and optimization. This paper presents an Artificial Intelligence (AI)-driven framework for a Power Consumption Calculator capable of estimating, forecasting, and optimizing device energy usage. By analyzing device specifications, operational conditions, and usage patterns, the proposed model employs predictive analysis to accurately forecast energy demand while recommending cost-efficient strategies. Furthermore, the integration of AI with Internet of Things (IoT)-enabled devices enables real-time monitoring, adaptive learning, and continuous optimization, thereby creating a smarter and more connected energy management ecosystem. The system empowers users with user-friendly interfaces for energy tracking, while supporting broader goals of energy conservation, cost reduction, and environmental sustainability. By extending device lifespan and reducing carbon footprints, this framework contributes to the global transition toward greener and more sustainable technologies.

Keywords: Artificial Intelligence, Power Consumption, Smart Devices, Energy Optimization, IoT, Predictive Analysis, Sustainable Technology

AI BASED BATTERY HEALTH MONITORING

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Abstract: Battery health monitoring is crucial for ensuring the reliability, efficiency, and safety of energy storage systems used in electric vehicles, consumer electronics, and renewable energy applications. Traditional methods often rely on physical sensors and empirical models, which may not provide accurate real-time insights into the state of health (SOH) and remaining useful life (RUL) of batteries. This project proposes an Artificial Intelligence (AI)-based approach to battery health monitoring that leverages machine learning and deep learning techniques to analyze voltage, current, temperature, and charge-discharge cycle data. By training predictive models on historical and real-time data, the system can detect degradation patterns, forecast failures, and optimize battery usage. The implementation of AI not only enhances prediction accuracy but also reduces maintenance costs, prolongs battery life, and contributes to the development of sustainable energy solutions.

Keywords: Battery health monitoring, Artificial Intelligence, Machine learning, Deep learning, State of health.

AN INTELLIGENT IOT- ENABLED WEATHER MONITORING SYSTEM TO SUPPORT FARMERS

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Abstract: Agriculture is highly sensitive to weather variability, making accurate and timely meteorological data essential for informed decision-making. This paper presents an intelligent IoT-enabled weather monitoring system designed to support farmers by providing real-time, location-specific climate insights. The system integrates sensors to measure temperature, humidity, rainfall, wind speed, and soil moisture, transmitting data via wireless networks to cloud-based platforms. Advanced analytics and machine learning algorithms process this data to generate actionable forecasts and alerts. Farmers can access this information through mobile apps or web dashboards, enabling them to optimize irrigation schedules, plan crop cycles, and mitigate risks from extreme weather events. The system also supports historical data analysis for long-term agricultural planning. By enhancing situational awareness and reducing dependency on traditional weather sources, this IoT-based solution empowers farmers to improve productivity, conserve resources, and adapt to climate change. The paper discusses system architecture, implementation challenges, and future scalability, emphasizing its potential to revolutionize precision agriculture.

Keywords: IoT in Agriculture, Weather Monitoring System, Smart Farming, Precision Agriculture, Real-Time Climate Data, Sensor Networks

HDP AN EFFICIENT HANDWRITTEN DIGIT PREDICTION MODEL USING MACHINE LEARNING

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Abstract: The handwritten digit predictor is an artificial intelligence (AI) project developed using machine learning (ML) and deep learning (DL) techniques to classify handwritten numerical digits (0–9). The system is trained and tested on the MNIST dataset, which contains 70,000 labeled grayscale images of handwritten digits. By applying Convolutional Neural Networks (CNNs), the model learns to automatically extract features such as curves, edges, orientation, and pixel intensity patterns, enabling high accuracy in digit recognition. The project demonstrates the integration of computer vision, pattern recognition, and image processing methods in real-world applications. Potential uses include bank check verification, postal code recognition, digital form processing, optical character recognition (OCR), document automation, and intelligent input systems. This project highlights the effectiveness of neural networks in solving classification problems and serves as an introductory platform for students and researchers to understand the implementation of AI and ML in image-based predictive modeling.

Keywords: Handwritten Digit Recognition, Artificial Intelligence, Machine Learning, Deep Learning, Neural Networks, Computer Vision, Convolutional Neural Networks(CNN)

AI- POWERED SMART PROSTHETICS WITH EMF SIGNAL ANALYSIS

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Abstract: This project focuses on the development of an AI-powered smart prosthetic limb that uses Electromyography (EMG) signal analysis to interpret muscle activity for intuitive and precise movement control. By integrating advanced machine learning algorithms, the system can learn and adapt to the unique muscle patterns of individual users, enabling real-time responsiveness and improved functionality. The prosthetic enhances user comfort, mobility, and overall quality of life. This approach combines biomedical engineering, signal processing, and artificial intelligence to create a more natural and efficient human-machine interface, representing a significant innovation in assistive technologies for amputees.

Keywords: AI, smart prosthetic, EMG signal, machine learning, biomedical engineering, assistive technology.

AI-DRIVEN SMART IRRIGATION SYSTEM USING IOT FOR WATER CONSERVATION IN AGRICULTURE

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Abstract: Water scarcity is one of the most critical challenges faced by the agricultural sector, especially in regions with limited freshwater resources. Traditional irrigation methods often lead to excessive water usage and inefficient distribution, negatively impacting both crop yield and sustainability. This project proposes an AI-driven smart irrigation system using IoT (Internet of Things) to optimize water usage in agriculture and promote precision farming. The system integrates soil moisture sensors, temperature and humidity sensors, **and** weather forecasting APIs to collect real-time environmental data from the field. This data is transmitted to a cloud-based platform where AI algorithms analyze crop water requirements, taking into account factors such as soil type, weather patterns, and crop stage. Based on this analysis, the system automatically controls irrigation valves to deliver the optimal amount of water needed, minimizing wastage and preventing under- or over-irrigation.

Keywords: Smart Irrigation, Artificial Intelligence (AI), Internet of Things (IoT), Precision Agriculture, Water Conservation, Soil Moisture Sensors, Automated Irrigation System

SOLAR-POWERED ROBOTIC LAWN MOWER WITH PATH PLANNING AND COLLISION AVOIDANCE

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Abstract: The increasing demand for automation and sustainable energy solutions has led to the development of intelligent systems powered by renewable sources. This project presents the design and implementation of a solar-powered robotic lawn mower equipped with path planning and collision avoidance capabilities. The system harnesses solar energy through photovoltaic panels to charge an onboard battery, providing a clean and renewable power source for continuous operation. A microcontroller-based control unit governs the mower's movement, utilizing sensors such as ultrasonic or infrared modules to detect obstacles and ensure safe navigation. The mower employs a path planning algorithm to optimize coverage of the mowing area while minimizing energy consumption and operational time. The integration of renewable energy with autonomous control enhances efficiency, reduces human effort, and contributes to environmental sustainability. Experimental results demonstrate that the proposed system effectively performs autonomous grass cutting with accurate obstacle detection and optimized path coverage, making it a cost-effective and eco-friendly alternative to conventional lawn maintenance methods.

Keywords: Solar Energy, Robotic Lawn Mower, Path Planning, Collision Avoidance, Autonomous Navigation, Renewable Energy, Microcontroller

LIGHTWEIGHT DEEP LEARNING MODELS FOR EDGE IOT DEVICES

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Abstract: The rapid growth of the Internet of Things (IoT) has led to an increasing demand for intelligent edge devices capable of performing real-time analytics with minimal latency and power consumption. Traditional deep learning models, while highly accurate, are computationally intensive and unsuitable for low-resource IoT environments. This project focuses on the development and optimization of lightweight deep learning models designed specifically for edge IoT devices. Techniques such as model pruning, quantization, and knowledge distillation are employed to reduce model size and computational complexity without significantly compromising accuracy. The proposed system enables efficient on-device inference for tasks like image recognition, anomaly detection, and sensor data analysis. Implementations on edge hardware platforms such as Raspberry Pi, NVIDIA Jetson Nano, and ESP32 demonstrate substantial improvements in processing speed, memory usage, and energy efficiency. The results highlight the potential of lightweight AI models in enabling scalable, cost-effective, and energy-aware intelligence across IoT ecosystems, supporting applications in smart homes, healthcare, and industrial automation.

Keywords: Edge Computing, Internet of Things (IoT), Lightweight Deep Learning, Model Compression, Quantization, Pruning, Knowledge Distillation, On-Device Inference.

COMPUTING EFFICIENT AI ACCELERATOR FOR IOT DEVICES

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Abstract: The rapid proliferation of the Internet of Things (IoT) has created a pressing need for artificial intelligence (AI) processing at the edge, where devices are constrained by limited power, memory, and computing resources. Conventional cloud-based AI solutions suffer from high latency, excessive bandwidth usage, and privacy concerns. To overcome these challenges, computing-efficient AI accelerators are being developed to enable real-time data processing within IoT devices themselves. By leveraging techniques like quantization, pruning, and model compression, AI accelerators significantly reduce energy consumption while maintaining acceptable accuracy. Ongoing research focuses on lightweight deep learning models, heterogeneous computing frameworks, and adaptive hardware-software co-design to ensure efficient deployment across diverse IoT environments. As demand for intelligent, low-power, and secure edge devices increases, computing-efficient AI accelerators emerge as a cornerstone technology for the future of pervasive IoT systems.

Keywords: AI accelerator, Internet of Things (IoT), Edge computing, Energy efficiency, Hardware optimization, Model compression.

SYNERGY OF EMERGING TECHNOLOGIES AND AI FOR FUTURE INNOVATIONS

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Abstract: This project develops a smart home automation system focused on energy conservation and enhanced security. IoT-enabled devices control lighting, appliances, and climate systems based on user preferences and occupancy. Sensors detect motion, temperature, and humidity to optimize energy usage. Automated scheduling reduces power consumption during peak hours. Security features include surveillance cameras, door sensors, and remote access control. The system integrates with mobile apps for real-time monitoring and control. Voice assistants and smart hubs enhance user interaction and convenience. Data analytics provide insights into energy patterns and suggest improvements. Solar energy integration supports sustainable power management. Emergency alerts are triggered during intrusions or system failures. The design emphasizes modularity and scalability for different home sizes. Wireless protocols like Zigbee and Wi-Fi ensure seamless connectivity. Encryption and authentication safeguard user data and system access. User-friendly interfaces promote adoption across demographics. The system adapts to changing environmental and user conditions. It supports smart grid integration and demand-side energy management. Field testing validates reliability, responsiveness, and user satisfaction. The project contributes to green living and smart infrastructure. It aligns with global goals for energy efficiency and digital transformation. This innovation redefines modern living through intelligent automation.

Keywords: Zigbee and Wi-Fi, devices control lighting, appliances, and climate systems

SMART HUMAN EMOTION RECOGNITION FROM VOICE USING AI

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Abstract: Voice emotion detection analyzes speech patterns to identify emotional states, enabling applications in customer service, mental health, and human-computer interaction. However, challenges include variability in emotional expression, where emotions are expressed differently across cultures and individuals, noise and interference that can affect system accuracy, and the complexity of human emotions, which can be complex and nuanced. To address these challenges, our solution involves utilizing advanced machine learning models, to recognize emotional patterns. We also employ robust feature extraction methods to extract relevant acoustic features like pitch and tone. Additionally, our approach includes multi-label classifications, which enables detecting multiple emotions simultaneously. Our approach includes several key steps: data collections, where we gather diverse emotional speech datasets; feature relevant to emotions; model training, where we train models to recognize emotional patterns; and evaluation, where we test system performance on various datasets. By developing voice emotion detection technology, we can improve human-computer interaction, enabling more empathetic interactions; we can also enhance customer service by providing insights into customer emotion and support mental health applications by facilitating early detection and intervention.

Keywords: Voice, Emotion, Detection, Machine, Learning.

IOT BASED AIR QUALITY MOTORING SYSTEM

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Abstract: This project presents an IoT-based air quality monitoring system using Arduino and low-cost sensors to measure pollutants such as carbon dioxide (CO₂), carbon monoxide (CO), and smoke, along with temperature and humidity levels. The sensor data is processed by the microcontroller and displayed locally on an LCD, while a Wi-Fi module enables real-time transmission to a cloud platform for remote monitoring through mobile or web applications. The system also provides alerts when pollutant levels exceed safe limits and can be extended to automatically control ventilation devices, making it a simple, cost-effective, and scalable solution for homes, schools, industries, and urban environments.

Keywords: IoT, Air Quality Monitoring, Arduino, Low-cost Sensors, CO₂, CO, Smoke Detection, Cloud Platform, Real-time Monitoring, Ventilation Control.

AI – BASED SENTIMENT ANALYSIS OF PRODUCT REVIEWS

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Abstract: With the rapid growth of e-commerce platforms, customers often rely on online product reviews before making purchase decisions. However, the sheer number of reviews makes it hard for users and businesses to extract meaningful insights manually. This study focuses on developing an AI-based sentiment analysis system that automatically classifies product reviews as positive, negative, or neutral. Using natural language processing (NLP) techniques and machine learning models, the system analyzes textual data to identify customer opinions and emotions. Preprocessing steps such as tokenization, stop-word removal, and stemming are applied to improve accuracy. Various algorithms like logistic regression, support vector machines, and deep learning models such as LSTM are evaluated for performance. The results show that AI-driven sentiment analysis offers an efficient and scalable solution for understanding customer feedback, helping businesses improve product quality, boost customer satisfaction, and make data-driven decisions.

Keywords: Voice Sentiment analysis, artificial intelligence (AI), natural language processing (NLP), machine learning, product reviews, text classification, opinion mining.

IOT AIR & SOUND POLLUTION MONITORING SYSTEM

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Abstract: The project aims in designing a “iot air and sound pollution monitoring system” the increasing air and sound pollution is one of the significant issue now days. as the pollution increasing it is giving rise number of diseases so, it has become essential to control the pollution for better future and healthy life .here we propose an air quality as well as sound pollution monitoring system that allows us to monitor and check live air quality as well as sound pollution monitoring in particular areas through IOT.System uses air sensor to detect or sense presence of harmful gases, compounds in the air and constantly transmit data to microcontroller. also system keeps measure soundlevel and report it to the online server over iot. the user friendly and easy handling of the system technology is such that it can be installed in houses, schools and in smallplaces.

Keywords: AurduinoUno, Gas Sensor MQ135, Sound Sensor LM393, Wifi Module.

GREEN IOT FOR SMART CITIES

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Abstract: Green IoT (Internet of Things) is an emerging paradigm that focuses on minimizing energy consumption, reducing carbon footprints, and ensuring sustainable practices in IoT deployments. In the context of smart cities, Green IoT plays a crucial role by integrating energy-efficient devices, low-power communication protocols, and eco-friendly technologies. A smart city involves interconnected infrastructure such as transportation, healthcare, energy grids, waste management, and water supply systems. Green IoT enhances these services while ensuring sustainability. The adoption of energy harvesting sensors, solar-powered devices, and lightweight protocols such as 6LoWPAN, CoAP, and MQTT enables resource conservation. Moreover, cloud computing combined with edge and fog computing reduces energy-hungry data transmissions. Techniques like green data centers, virtualization, and optimized routing protocols are widely employed to cut down emissions. In transport, Green IoT facilitates smart traffic control and electric vehicle charging systems, lowering pollution. In energy sectors, smart grids powered by renewable sources enable efficient distribution and monitoring. In waste management, sensor-enabled bins optimize collection schedules, reducing fuel usage.

Keywords: Green IoT, Smart Cities, Sustainability, Energy Efficiency, Smart Grid, Smart Transportation, Smart Healthcare, Smart Waste Management.

FIRE FIGHTER ROBOT WITH NIGHT VISION CAMERA USING AI

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Abstract: Fire accidents pose severe risks to human life and property, especially in environments with poor visibility caused by smoke or darkness. To address this challenge, this work presents the design and development of an autonomous fire-fighting robot integrated with a night vision camera and artificial intelligence. The robot employs thermal and low-light imaging to detect fire sources accurately, even in dark or smoke-filled conditions. An AI-based detection algorithm processes real-time visual data to identify flames and hotspots with high reliability, while an autonomous navigation system ensures obstacle avoidance and safe movement within the affected area. The robot can relay live video footage to a control station and, if equipped, deploy a fire suppression mechanism to mitigate the fire at its source. By combining mobility, intelligent vision, and remote monitoring, this system enhances the efficiency and safety of fire response operations, reducing risks to human firefighters and enabling timely intervention.

Keywords: Fire-fighting robot, Artificial Intelligence, Night Vision Camera, Thermal Imaging, Autonomous Navigation, Fire Detection

AUTOMATED NIGHT LIGHTING SYSTEM

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Abstract: Green IoT (Internet of Things) is an emerging paradigm that focuses on minimizing energy consumption, reducing carbon footprints, and ensuring sustainable practices in IoT deployments. In the context of smart cities, Green IoT plays a crucial role by integrating energy-efficient devices, low-power communication protocols, and eco-friendly technologies. A smart city involves interconnected infrastructure such as transportation, healthcare, energy grids, waste management, and water supply systems. Green IoT enhances these services while ensuring sustainability. The adoption of energy harvesting sensors, solar-powered devices, and lightweight protocols such as 6LoWPAN, CoAP, and MQTT enables resource conservation. Moreover, cloud computing combined with edge and fog computing reduces energy-hungry data transmissions. Techniques like green data centers, virtualization, and optimized routing protocols are widely employed to cut down emissions. In transport, Green IoT facilitates smart traffic control and electric vehicle charging systems, lowering pollution. In energy sectors, smart grids powered by renewable sources enable efficient distribution and monitoring. In waste management, sensor-enabled bins optimize collection schedules, reducing fuel usage.

Keywords: Automated lighting, night lighting system, motion detection, ambient light sensing, energy efficiency, adaptive dimming, occupancy-based control, microcontroller, smart home integration, LED lighting.

SMART DUSTBIN WITH IOT NOTIFICATIONS

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Abstract: The rapid growth of urbanization has increased the demand for effective waste management systems. Conventional dustbins often overflow due to irregular waste collection, leading to unhygienic conditions and environmental hazards. To address this issue, a smart dustbin integrated with Internet of Things (IoT) technology is proposed. The system uses ultrasonic sensors to monitor the waste level inside the bin and automatically sends real-time notifications to the concerned authorities when the bin is nearly full. The collected data is transmitted through a Wi-Fi or GSM module to a cloud platform, where it can be accessed and analyzed for efficient route planning and timely collection. This approach reduces manual monitoring, prevents overflow, and promotes a cleaner environment. The smart dustbin with IoT notifications is a cost-effective and scalable solution that contributes toward building smarter and more sustainable cities.

Keywords: Smart Dustbin, Internet of Things (IoT), Waste Management, Ultrasonic Sensor, Real-Time Notification, Cloud Monitoring, Sustainable Cities, Automation.

AN INTELLIGENT FIRE MONITORING AND ALERTING FRAMEWORK

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Abstract: Fire hazards pose a significant threat to life, property, and the environment, necessitating rapid detection and response mechanisms. This paper proposes an intelligent fire monitoring and alerting framework that integrates sensor networks, machine learning algorithms, and real-time communication protocols to enhance fire safety. The system utilizes multi-sensor data—such as temperature, smoke, and gas levels—processed through AI models to accurately detect fire incidents while minimizing false alarms. A cloud-based architecture ensures scalability and remote access, while edge computing enables low-latency decision-making. The alerting mechanism includes SMS, email, and app notifications, ensuring timely dissemination of warnings to relevant stakeholders. The framework also supports integration with emergency services and IoT devices like sprinklers and surveillance cameras. Experimental results demonstrate high accuracy, fast response times, and robust performance in diverse environments. This intelligent system offers a proactive approach to fire safety, suitable for smart buildings, industrial zones, and forest monitoring applications.

Keywords: Fire Detection, Intelligent Monitoring, Sensor Networks, Machine Learning, IoT, Edge Computing, Cloud Architecture, Real-Time Alerts.

COMPUTING EFFICIENT AI ACCELERATOR FOR IOT DEVICES

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Abstract: The rapid growth of urbanization has increased the demand for effective waste management systems. Conventional dustbins often overflow due to irregular waste collection, leading to unhygienic conditions and environmental hazards. To address this issue, a smart dustbin integrated with Internet of Things (IoT) technology is proposed. The system uses ultrasonic sensors to monitor the waste level inside the bin and automatically sends real-time notifications to the concerned authorities when the bin is nearly full. The collected data is transmitted through a Wi-Fi or GSM module to a cloud platform, where it can be accessed and analyzed for efficient route planning and timely collection. This approach reduces manual monitoring, prevents overflow, and promotes a cleaner environment. The smart dustbin with IoT notifications is a cost-effective and scalable solution that contributes toward building smarter and more sustainable cities.

Keywords: Smart Dustbin, Internet of Things (IoT), Waste Management, Ultrasonic Sensor, Real-Time Notification, Cloud Monitoring, Sustainable Cities, Automation.

INTELLIGENT HEALTH MONITORING SYSTEM USING IOT

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Abstract: The integration of Internet of Things (IoT) technology into healthcare has revolutionized patient monitoring and medical diagnostics. An Intelligent Health Monitoring System (IHMS) powered by IoT enables real-time tracking of vital signs such as heart rate, blood pressure, oxygen saturation, and body temperature using wearable sensors and smart devices. These systems collect, transmit, and analyze health data continuously, allowing for early detection of anomalies and timely medical intervention. By leveraging cloud computing and AI-based analytics, IHMS can provide personalized insights, automate alerts, and support remote consultations. This reduces the burden on healthcare infrastructure and enhances patient outcomes, especially for chronic disease management and elderly care. The system's architecture typically includes sensor nodes, microcontrollers, wireless communication modules, and a centralized data platform accessible to both patients and healthcare providers. Security, data privacy, and interoperability are critical challenges that must be addressed to ensure widespread adoption. This paper explores the design, functionality, and impact of IoT-based intelligent health monitoring systems, highlighting their role in shaping next-generation healthcare delivery.

Keywords: Internet of Things (IoT), Health Monitoring System, Wearable Sensors, Remote Patient Monitoring, Vital Signs Tracking, Smart Healthcare, Cloud Computing

ARDUINO-CONTROLLED OBSTACLE DETECTION AND ALERT SYSTEM WITH ULTRASONIC SENSORS

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Abstract: Obstacle detection systems are vital in enhancing safety and automation across various applications, from robotics to smart vehicles. This paper presents the design and implementation of an Arduino-controlled obstacle detection and alert system using ultrasonic sensors. The system utilizes ultrasonic waves to measure the distance between the sensor and nearby objects, enabling accurate detection of obstacles in real-time. When an object is detected within a predefined range, the system triggers an alert mechanism—such as a buzzer or LED—to notify users of potential hazards. The core of the system is built around an Arduino microcontroller, which processes input from the ultrasonic sensor and controls the output devices. This project demonstrates how embedded systems and sensor technologies can be combined to create intelligent, responsive solutions. Future enhancements may include wireless communication, AI-based decision-making, and integration with GPS for advanced navigation. The proposed system serves as a foundational model for developing smart, sensor-driven safety applications.

Keywords: Arduino, Ultrasonic Sensor, Obstacle Detection, Alert System, Embedded Systems, Distance Measurement

PREDICTING SEX FROM RETINAL FUNDUS PHOTOGRAPHS USING AUTOMATED DEEP LEARNING

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Abstract: Deep learning has demonstrated remarkable potential in transforming healthcare through automated image-based diagnosis. In this study, we present a clinician-driven deep learning approach capable of predicting biological sex from retinal fundus photographs without the need for programming expertise. The model was trained on 84,743 fundus images from the UK Bio bank dataset and externally validated on 252 retinal photographs from a tertiary ophthalmic referral centre. The model achieved an area under the receiver operating characteristic curve (AUROC) of 0.93, with internal accuracy of 88.6% and external validation accuracy of 78.6%. These results indicate that retinal fundus images contain subtle, previously unrecognized sex-specific features not discernible by clinicians. Our findings highlight the potential of automated deep learning systems to reveal novel biological insights, while emphasizing the importance of model explain ability and interpretability in medical AI applications.

Keywords: Deep Learning, Retinal Fundus Imaging, Sex Prediction, Automated Machine Learning, Explainable AI, Ophthalmology, Biomedical Image Analysis, Artificial Intelligence in Healthcare.

IOT-ENABLED SMART WASTE SEGREGATION AND MONITORING SYSTEM USING EMBEDDED INTELLIGENCE

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Abstract: Urban population growth has intensified challenges in municipal solid waste management, where conventional collection remains inefficient, costly, and environmentally unsustainable. Issues such as overflowing bins, irregular schedules, and poor segregation lead to health risks, greenhouse gas emissions, and missed recycling opportunities. Existing smart solutions focus mainly on bin fill-level monitoring, overlooking segregation, predictive analytics, and integrated optimization. This paper presents an IoT-based smart waste segregation and monitoring system. Prototype testing achieved over 90% segregation accuracy, improved collection efficiency by 30%, and reduced costs by 20%. Scalable and solar-powered, the system offers a practical, low-cost, and sustainable solution for smart cities. In comparison to standard approaches, the suggested system enhanced collection efficiency by 30% and lowered operating costs by 20%. Additionally, timely identification of biodegradable waste prevented foul odours, pest infestation, and uncontrolled methane release. It also includes predictive analytics that utilizes real-time and historical data to predict waste generation trends and plan collection routes for optimal efficiency.

Keywords: Deep Learning, Retinal Fundus Imaging, Sex Prediction, Automated Machine Learning, Explainable AI, Ophthalmology, Biomedical Image Analysis, Artificial Intelligence in Healthcare.

5G AND ITS IMPACT ON IOT

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Abstract: The emergence of 5G technology represents a major milestone in the advancement of wireless communication, offering unprecedented speed, minimal latency, and improved connectivity. This breakthrough is set to greatly influence the Internet of Things (IoT), a vast network of interconnected devices that depend on seamless communication to deliver intelligent services across diverse domains. Unlike earlier generations, 5G is designed to overcome challenges such as network congestion, limited bandwidth, and communication delays that have restricted the true capabilities of IoT. This paper examines the impact of 5G on IoT, highlighting its role in enabling real-time data processing, greater scalability, and enhanced reliability. It further explores how 5G can pave the way for innovative IoT applications ranging from smart cities to industrial automation, while also addressing the opportunities and challenges that accompany this technological evolution. By exploring the convergence of 5G and IoT, this paper seeks to present a holistic view of their transformative influence on the future of connected ecosystems.

Keywords: 5G Technology, Internet Of Things (Iot), Low Latency, Smart Devices, Network Security.

SRAM DESIGN CHALLENGES AND INNOVATIONS FOR ENERGY-CONSTRAINED IOT PLATFORMS

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Abstract: The evolution of Internet of Things (IoT) platforms has shifted memory design requirements from performance-centric models to energy-constrained, context-aware architectures. As SRAM continues to dominate on-chip memory due to its speed and scalability, its integration into ultra-low power IoT nodes faces unique challenges. Beyond conventional issues of leakage and process variability, IoT systems demand adaptive memory capable of dynamic voltage operation, data-retention in intermittent energy environments, and resilience under aggressive power gating. This paper examines the next wave of SRAM design innovations tailored for energy-constrained IoT devices, including adaptive body-biasing, 8T/10T cell topologies for stability at near-threshold voltages, and hybrid SRAM–non-volatile memory architectures for persistent computing. We further discuss the role of AI-driven design space exploration in optimizing power-performance trade-offs for IoT workloads. By bridging device-level enhancements with architecture-aware techniques, this study highlights how SRAM can evolve into a sustainable memory backbone for future IoT ecosystems.

Keywords: Low-power SRAM, IoT memory, near-threshold design, hybrid SRAM–NVM, adaptive circuits, persistent computing.

AI-DRIVEN INNOVATIONS IN 3D IC FABRICATION FOR NEXT-GENERATION HIGH-PERFORMANCE VLSI SYSTEMS

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Abstract: The rapid evolution of computing paradigms—spanning AI accelerators, edge computing, and high-performance SoC’s—demands breakthroughs beyond conventional 2D integration. As Moore’s law faces scaling saturation, 3D Integrated Circuits (3D IC’s) have emerged as a trans-formative solution, enabling vertical integration of logic, memory, and heterogeneous components for unprecedented bandwidth, power efficiency and performance density. This paper explores cutting-edge innovations in 3D IC fabrication that are shaping next-generation high-performance VLSI systems. We analyze recent advances in hybrid wafer-to-wafer and die-to-wafer bonding, monolithic 3D (M3D) integration using low-temperature sequential stacking, and fine-pitch through-silicon via (TSV’s) optimized with nanometre-scale aspect ratios. Beyond conventional manufacturing, we highlight the rise of AI-assisted fabrication process control, machine-learning-based yield prediction, and self-healing interconnects architectures that enhance reliability in multi-tier 3D stacks. Emerging material innovations such as grapheme interconnects, carbon nanotube TSV’s, and low- κ / high-thermal-conductivity dielectrics are examined for their potential to reduce parasitic and improve heat dissipation. Thermal challenges are addressed through 3D microfluidic cooling, embedded phase-change heat spreaders

Keywords: 3D IC, monolithic integration, hybrid bonding, AI-assisted fabrication, heterogeneous stacking, graphene interconnects, microfluidic cooling, thermal-aware design, VLSI systems

INTELLIGENT POWER OPTIMIZATION STRATEGIES FOR ENHANCED EFFICIENCY IN ELECTRIC VEHICLES

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Abstract: Electric vehicles (EVs) are at the forefront of sustainable transportation, yet their performance and driving range are critically dependent on efficient power management. This paper presents a comprehensive study on intelligent power optimization strategies aimed at maximizing energy efficiency and extending battery life in EVs. The research emphasizes the integration of advanced battery management systems, regenerative braking, and adaptive energy distribution algorithms that respond to real-time driving conditions. Furthermore, the application of predictive control methods and machine learning techniques enables precise power allocation across the powertrain while minimizing energy losses. The influence of route selection, driving patterns, and auxiliary loads on overall vehicle efficiency is also analyzed. Simulation and experimental results indicate that implementing these strategies can lead to significant improvements in energy utilization, operational cost reduction, and enhanced system reliability.

Keywords: Electric vehicles, IoT memory, battery management.

EMERGING TRENDS IN SOFT ROBOTIC PROSTHETIC HANDS: A CRITICAL REVIEW

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Abstract: This paper critically reviews the recent advances in soft robotic prosthetic hands with a focus on myoelectric (EMG) signal processing, artificial intelligence (AI)-based control algorithms, and integrated soft robotic hardware. Soft robotics offers compliant, adaptive, and safer alternatives to conventional rigid prostheses, enhancing human-machine interaction. The integration of EMG-based control systems with AI algorithms has led to significant improvements in gesture recognition, motion intention decoding, and tactile feedback restoration. We summarize the state-of-the-art in soft actuator designs, sensor arrays, control strategies, and AI models applied to prosthetic hands, providing a comparative analysis and highlighting key challenges, limitations, and future research directions.

Keywords: *Soft Robotics, Prosthetic Hand, EMG, Myoelectric Control, Artificial Intelligence, Sensor Integration, Soft Actuators*

IOT CONTROLLED LED NOTICE BOARD FOR STUDENT CIRCULAR UPDATES VIA WI-FI

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Abstract: Notice boards play a very important role in our day-to-day life as a medium of communication and information dissemination. Traditional notice boards, however, are analog in nature and require manual intervention to update or replace notices. This process is time-consuming, labour-intensive, and involves the use of paper, making it less efficient in today's digital era. By replacing conventional notice boards with digital ones, we can make the sharing of information faster, more reliable, and eco-friendly. Digital notice boards can be especially useful in public spaces such as bus stations, railway stations, shopping malls, educational institutions, and industries, where information needs to be updated frequently and communicated to a large audience in real-time. Messages can be updated remotely through IoT, eliminating the need for manual intervention. In educational institutions, for instance, students often miss important announcements such as schedule changes or event updates if they do not pass by the notice board at the right time. Similarly, in industries or offices, project-based or temporary notice boards can become cluttered and difficult to maintain, with no systematic mechanism for updating or removing outdated information. With a digital IoT-enabled notice board, institutions can centralize announcements and ensure timely delivery of information across the campus or workplace.

Keywords: *Node MCU, LED Matrix, Transformers, Rectifiers Arduino IDE, Blynk Server.*

HIGH-PERFORMANCE PHOTODETECTORS BASED ON 2D MOS GRAPHENE HETEROSTRUCTURES FOR NEXT-GENERATION OPTOELECTRONICS

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Abstract: The rapid progress in optoelectronic device research has created opportunities to address the challenges of high power consumption and limited sensitivity in conventional photodetectors. In this work, we present a two-dimensional MoS₂–graphene heterostructure photodetector designed to achieve high responsivity and ultrafast response time. The methodology involves chemical vapor deposition of large-area MoS₂, followed by transfer integration with monolayer graphene, and subsequent fabrication using electron-beam lithography. Electrical and optical characterizations demonstrate a responsivity of 820 A/W at 532 nm and a response time of less than 30 μs. Compared to conventional silicon-based devices, our approach shows superior sensitivity, broadband detection capability, and scalability. The results highlight the potential of MoS graphene heterostructure devices for applications in high-speed optical communication, biomedical imaging, and low-power sensing. This study contributes to advancing the field of optoelectronics by demonstrating a material platform that combines atomic-scale thickness, excellent carrier transport, and tunable optoelectronic properties.

Keywords: optoelectronics, Photo detectors, 2D materials, MoS, Graphene, Heterostructures

AUTONOMOUS PRECISION AGRICULTURE: AN AI AND ROBOTIC VISION SYSTEM FOR TARGETED PESTICIDE APPLICATION

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Abstract: Traditional agriculture relies on blanket pesticide spraying, leading to excessive chemical use, environmental damage, and increased operational costs. This paper presents an innovative solution for precision crop protection through the design and implementation of an Autonomous Precision Agriculture (APA) system, exemplified by the SPID concept. The APA system integrates robotic vision and Artificial Intelligence (AI) to enable real-time, infection-based dispensing. This data is fed into an on-board AI processor running a Convolutional Neural Network (CNN) model trained for instance segmentation and disease classification. The CNN accurately identifies, localizes, and classifies specific pests or diseases on a plant, even in their early stages. The AI then serves as a smart dispensing decision-maker, calculating the precise chemical type and minimal effective dosage. This highly targeted approach maximizes treatment efficacy while drastically reducing chemical usage and waste, ultimately supporting sustainable farming practices, minimizing environmental impact, and improving crop yield.

Keywords: Precision Agriculture, Autonomous Precision Agriculture (APA), Artificial Intelligence (AI), Convolutional Neural Network (CNN), Robotic Vision, Instance Segmentation, Disease Classification

CYBERSECURITY IN IOT AND CRITICAL INFRASTRUCTURE

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Abstract: The rapid proliferation of Internet of Things (IoT) devices and their integration into critical infrastructure sectors—such as energy, healthcare, transportation, and water systems—has introduced significant cybersecurity challenges. These systems are increasingly becoming targets for sophisticated cyberattacks, potentially leading to widespread disruption, data breaches, and physical damage. This paper explores the unique security vulnerabilities inherent in IoT-enabled critical infrastructure, such as constrained device resources, lack of standardization, and legacy system integration. It also analyzes emerging threats, attack vectors, and real-world incidents that illustrate the risks. Furthermore, the paper discusses current defense mechanisms, including network segmentation, intrusion detection systems (IDS), encryption protocols, and AI-driven anomaly detection. Emphasis is placed on the need for a holistic and proactive cyber security strategy that encompasses risk assessment, policy development, and regulatory compliance. Ultimately, the work aims to highlight best practices and propose future directions for securing the interconnected landscape of IoT in critical infrastructure

Keywords: *Cyber security, IOT, Critical Infrastructure*

IMPLEMENTATION OF HOME AUTOMATION USING GOOGLE ASSISTANT AND BLYNK

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Abstract: Home automation using Google Assistant and Blynk enables users to control household devices through voice commands. Blynk is an open-source mobile platform with its own cloud server that processes user requests. It allows users to control devices, monitor sensor data, and receive notifications based on specific trigger actions. The system integrates with the IFTTT website, where voice commands for Google Assistant are configured. When a user gives a command to Google Assistant, home appliances such as lights, fans, and motors can be operated accordingly. The NodeMCU (ESP8266) microcontroller is used for this system, and communication between the device and the application takes place via Wi-Fi. With continuous advancements in automation technology, daily life has become more convenient and efficient. In the modern era, automated systems are increasingly preferred over manual operation. The rapid growth of internet users has made the Internet an essential part of everyday life, and the Internet of Things (IoT) has emerged as one of the most innovative and fast-growing technologies in this field.

Keywords: *Home automation, Google Assistant, Blynk, IoT, NodeMCU, ESP8266, Wi-Fi, voice control, smart home, IFTTT, sensors, cloud, and automation.*

FACE RECOGNITION DOOR LOCK SECURITY SYSTEM WITH EMERGENCY MANUAL AUTHENTICATION

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Abstract: In today's era of automation and smart devices, there is a crucial need to alter the security measures of systems as privacy and security are notable issues in information systems. Traditional door locking systems, which rely on mechanical locks and physical keys, have limitations including key management issues and vulnerability to unauthorized access. This paper proposes an innovative Smart Door Unlock System based on Face Recognition with Emergency Manual Authentication capability. The system uses an ESP32-CAM module to capture and recognize authorized faces automatically. The key innovation of this system is the integration of a manual authentication mechanism: when an unknown person is detected, a notification is sent to the user's mobile device, allowing the user to grant or deny access in emergency situations remotely. This hybrid approach combines automated face recognition with human decision-making, providing enhanced security and flexibility. The system addresses limitations of fully automated systems while maintaining convenience and accessibility for elderly and disabled individuals.

Keywords: IoT, Face Recognition, Machine Learning, Smart Door Security, ESP32-CAM, Manual Authentication, Emergency Access

SAI-DRIVEN PERSONALIZED INVESTMENT PORTFOLIO AND COMPANY SUCCESS PREDICTION SYSTEM

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Abstract: The increasing complexity of financial markets and the limitations of traditional investment tools have driven the need for intelligent, data-driven portfolio management solutions. This paper presents an AI- Driven Personalized Investment Portfolio and Company Success Prediction System designed to assist long- term investors in the Indian equity market, specifically focusing on the NIFTY 200 index. The proposed system integrates machine learning-based company success prediction with Modern Portfolio Theory (MPT) to generate optimized, risk-aware investment portfolios. The portfolio optimization module utilizes convex programming to balance risk and expected return while dynamically adapting to market conditions. Simulation and prototype results demonstrate improved portfolio performance, reduced manual intervention, and enhanced transparency in Investment decision-making.

Keywords: Artificial Intelligence, Portfolio Optimization, Machine Learning, Financial Forecasting, Investment Decision Support..

MEDICAL IMAGE DE-NOSING AND SUPER RESOLUTION USING DEEP LEARNING TECHNIQUES

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Abstract: Traditional medical image denoising techniques primarily focus on estimating either the clean image or the residual noise, often assuming a specific noise distribution such as Gaussian or speckle. However, real-world medical images are frequently affected by more complex and structured noise types, including ring and stripe artifacts, which cannot be accurately modeled by Gaussian or mixture-of-Gaussian assumptions. To address these limitations, this paper proposes a unified denoising framework that treats both the image and noise components equally by formulating the task as an image decomposition problem. Specifically, we develop a two-stage deep convolutional neural network (CNN) that simultaneously models the noise and image components. Furthermore, to alleviate the gradient vanishing issue in deep architectures, we incorporate both short-term and long-term skip connections to enhance information propagation.

Keywords: Medical image denoising, deep convolutional neural network (CNN), image decomposition, noise estimation, Gaussian noise, speckle noise, structured noise, ring artifacts, stripe artifacts, skip connections, computed tomography (CT), ultrasound imaging.

DEPARTMENT OF FOOD TECHNOLOGY

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CONTROLLING SPOILAGE OF FOOD IN REFRIGERATOR USING BIO-SENSORS & E-NOSE BASED ON IOT

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Abstract: Food spoilage in refrigerators poses a serious challenge, resulting in nutritional loss, economic damage, and health risks for consumers. This project presents an Internet of Things (IoT)-based system for controlling food spoilage in refrigerators using bio-sensors and an electronic nose (E-nose). Bio-sensors are employed to monitor key parameters such as temperature, humidity, and pH, while the E-nose detects volatile organic compounds (VOCs) and gas emissions produced during microbial activity and food deterioration. The collected real-time data is transmitted to a cloud-based platform, where intelligent algorithms analyze the patterns, detect anomalies, and generate alerts for early intervention. This ensures that food is stored under safe and optimal conditions, helping to prevent spoilage before it becomes critical. The proposed system can be applied in domestic refrigerators, cold storage facilities, and retail environments, thereby enhancing food safety, reducing waste, extending shelf life, and improving overall food quality management.

Keywords: Food spoilage, IoT, bio-sensors, E-nose, refrigerator monitoring, real-time detection, food safety.

DECISION TREE-BASED MACHINE LEARNING FOR IOT-BASED REAL-TIME DETECTION OF FOOD ADDITIVES

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Abstract: The widespread use of food additives in the food industry necessitates robust monitoring systems to ensure consumer safety and regulatory compliance. This study presents a decision tree-based machine learning framework integrated with an IoT-enabled system for real-time detection of food additives. The proposed system employs low-cost, sensor-equipped IoT devices to collect real-time data on the chemical composition and physical characteristics of food samples. A decision tree algorithm is utilized for its interpretability, fast computation, and suitability for embedded systems with limited resources. The model is trained on a labelled dataset of food samples containing both permitted and potentially harmful additives. It accurately classifies the presence of specific additives, enabling real-time alerts and monitoring. The system supports edge-level processing to minimize latency and reduce dependency on cloud resources. Experimental evaluation demonstrates high classification accuracy, low processing delay, and efficient resource utilization, making it a viable solution for real-time food quality control in industrial, retail, and domestic settings.

Keywords: Internet of Things (IoT), Decision Tree, Machine Learning, Real-Time Detection, Food Additives, Food Safety, Edge Computing, Smart Sensors

BIODEGRADABLE FOOD PACKING FROM NATURAL POLYMERS

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Abstract: The increasing concern over plastic waste in food packaging has encouraged the exploration of biodegradable alternatives derived from natural sources. Cucumber, a widely available vegetable rich in polysaccharides and fibers, offers potential for developing biodegradable packaging films. Extracts from cucumber peel and pulp contain bioactive compounds and natural polymers that can be processed into edible or biodegradable films with good transparency, flexibility, and antimicrobial properties. Such films not only reduce environmental pollution but also extend the shelf life of packaged foods by acting as a natural barrier against moisture and microbial growth. However, challenges such as low mechanical strength, limited water resistance, and large-scale processing efficiency need to be addressed through polymer blending, cross-linking, and incorporation of natural additives. Utilizing cucumber-based packaging materials contributes to waste valorization, sustainability, and circular economy practices, providing a low-cost and eco-friendly alternative to petroleum-based plastics in the food sector.

Keywords: Biodegradable packaging, cucumber peel, natural polymers, edible films, antimicrobial properties, waste valorization, sustainability, circular economy

ADULTERANT DETECTION IN DAIRY BASED PRODUCTS

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Abstract: An adulterant is a substance added to food products to increase quantity or reduce cost but which lowers quality, safety, or nutrition. Common adulterants in milk and dairy are water, starch, detergent, urea, formalin, synthetic milk, and neutralizers. IoT-enabled sensors can continuously monitor milk quality parameters like pH, conductivity, fat content, and temperature, which indicate adulteration. Sensors → collect milk quality data → IoT device transmits data → cloud/AI analysis → adulteration alerts. IoT systems enable real-time detection, automated quality checks, and immediate rejection of adulterated batches, ensuring consumer safety. Data from sensors (pH, turbidity, conductivity, NIR, biosensors) help detect deviations, confirm adulteration, and generate reports for quality assurance.

Keywords: Dairy products, Food adulteration, Milk safety, Adulterant detection, Food authenticity, Analytical techniques, Biosensors, Spectroscopy, Food quality, Public health

RANDOM FOREST-BASED MACHINE LEARNING FOR IOT-ENABLED DETECTION OF FOOD SPOILAGE

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Abstract: Food spoilage is a critical issue affecting public health, food security, and supply chain efficiency. This study proposes an IoT-enabled system enhanced with a Random Forest-based machine learning model for accurate and real-time detection of food spoilage. The system integrates various sensors (e.g., gas, temperature, humidity, and pH) to continuously monitor environmental and chemical parameters of food items. Data collected from these sensors is processed using a Random Forest algorithm, chosen for its robustness, high accuracy, and ability to handle nonlinear and high-dimensional data. The model classifies food as fresh, at-risk, or spoiled, enabling timely alerts and actions to prevent consumption of unsafe products. The architecture supports edge computing, reducing latency and enabling real-time decision-making without relying heavily on cloud resources. Experimental results show the proposed system achieves high classification accuracy and low false positive rates across various food categories. This work demonstrates the effectiveness of combining IoT and ensemble learning for smart food monitoring systems in storage, retail, and domestic environments.

Keywords: Internet of Things (IoT), Random Forest, Food Spoilage, Machine Learning, Real-Time Monitoring, Food Safety, Smart Sensors, Edge Computing

BLOCKCHAIN - BASED FOOD TRACEABILITY SYSTEM

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Abstract: Ensuring food safety, authenticity, and transparency has become a critical challenge in modern supply chains. Traditional traceability methods are often fragmented, prone to errors, and vulnerable to tampering, which makes it difficult to identify contamination sources or prevent food fraud. A blockchain-based food traceability system provides a decentralized and tamper-proof platform to record every step of the supply chain, from production and processing to distribution and retail. Each transaction is securely stored in an immutable ledger that can be accessed by all stakeholders. By integrating QR codes, consumers can instantly verify product origin, quality, and safety information, fostering trust and accountability. This approach not only strengthens food safety regulations but also improves recall efficiency, minimizes fraud, and supports sustainable supply chain.

Keywords: Internet of Things (IoT), Random Forest, Food Spoilage, Machine Learning, Real-Time Monitoring, Food Safety, Smart Sensors, Edge Computing

BIODEGRADABLE GLOVES: A COMBINATION OF DIFFERENT PLANT BASES

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Abstract: There is growing interest in the use of bio-based materials as viable alternatives to petrochemical-based {nitrile,vinyl} gloves . However, the practical application of bio-based films is often hampered by their poor barrier and poor mechanical properties. In this context, cellulose nanofibers (CNFs) have attracted considerable attention owing to their exceptional biodegradability, high aspect ratio, and large surface area. The extraction of CNFs from non-food biomass represents a sustainable approach that can effectively balance cost and environmental impacts of CNFs . This paper focuses on fabrication of biodegradable gloves using a palm leaf–derived cellulose matrix as the primary base material which enhances mechanical strength ,flexibility and durability, coconut leaf fibers were incorporated into the formulation, leveraging their high tensile resistance and fibrous reinforcement properties. Guava leaf extracts, known for their natural antimicrobial activity, were added to impart protection against microbial contamination, improving hygiene and safety standards during glove usage. Furthermore, lotus leaf–derived naturalplasticizers were employed to improve flexibility, elasticity, and wearability of the gloves without compromising biodegradability. The integration of these plant-based components results in an eco-friendly, cost-effective, reducing waste management cost.

Keywords: CNF (cellulose nano fibres); biodegradable gloves; performance Enhancing materials ; antimicrobial property.

IoT ENABLED SMART FARMING

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Abstract: Smart farming is the modern approach to agriculture that uses advanced technologiesto increase efficiency, productivity, and sustainability. Around the world, various smart farming practices such as precision agriculture, smart greenhouses, vertical farming,hydroponics, and livestock monitoring are being implemented to overcome challengesof limited land and rising food demand. The identification of smart farming using the Internet of Things (IoT) is achieved through connected sensors and devices that monitor soil moisture, pH, humidity, temperature, crop growth, and animal health. IoT detects farm conditions in simple ways such as measuring soil water content, recording weather parameters, and analyzing crop status through real-time data. Based on these insights, problems like over-irrigation, nutrient deficiency, pest control, and climate variation are solved through automated irrigation systems, predictive analytics, and smart decision- support tools. The results of IoT-enabled farming show that sensors and data analysis improve crop yield, optimize resource use, reduce costs, and promote sustainable agriculture, making IoT a key driver of global food security in the future.

Keywords: Smart Farming, IOT

AI-POWERED PERSONAL FARMING ASSISTANT FOR KERALA FARMERS

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Abstract: Agriculture remains the backbone of Kerala’s economy, yet farmers face challenges such as unpredictable weather, pest infestations, and inefficient resource management. This paper introduces an AI-powered personal farming assistant tailored to the specific needs of Kerala farmers. The system integrates real-time data from IoT sensors, satellite imagery, and local weather forecasts to provide personalized recommendations on irrigation, fertilization, pest control, and crop selection. Machine learning models analyze historical and environmental data to optimize farming practices, enhance crop yield, and reduce input costs. The assistant delivers actionable insights through a mobile application in the local language, ensuring accessibility and ease of use. Pilot studies with Kerala farmers demonstrate significant improvements in productivity and sustainable farming methods. This AI-driven solution empowers small-scale farmers by combining traditional knowledge with modern technology, fostering resilience and growth in Kerala’s agricultural sector.

Keywords: Artificial Intelligence, Personal Farming Assistant, Kerala Agriculture, IoT Sensors

IoT ENABLED SMART FERMENTATION PROCESS MONITORING

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Abstract: Food spoilage is a critical issue affecting public health, food security, and supply chain efficiency. This study proposes an IoT-enabled system enhanced with a Random Forest-based machine learning model for accurate and real-time detection of food spoilage. The system integrates various sensors (e.g., gas, temperature, humidity, and pH) to continuously monitor environmental and chemical parameters of food items. Data collected from these sensors is processed using a Random Forest algorithm, chosen for its robustness, high accuracy, and ability to handle nonlinear and high-dimensional data. The model classifies food as fresh, at-risk, or spoiled, enabling timely alerts and actions to prevent consumption of unsafe products. The architecture supports edge computing, reducing latency and enabling real-time decision-making without relying heavily on cloud resources. Experimental results show the proposed system achieves high classification accuracy and low false positive rates across various food categories. This work demonstrates the effectiveness of combining IoT and ensemble learning for smart food monitoring systems in storage, retail, and domestic environments.

Keywords: Internet of Things (IoT), Random Forest, Food Spoilage, Machine Learning, Real-Time Monitoring, Food Safety, Smart Sensors, Edge Computing

IoT-DRIVEN FOOD TRACEABILITY SYSTEM

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Abstract: Food safety and transparency have become global priorities as supply chains grow more complex. Traditional traceability methods often struggle with delayed data, inefficiency, and limited consumer trust. The Internet of Things (IoT) provides a modern approach to overcome these challenges by enabling real-time monitoring and data sharing across the entire food supply chain. The main objective of this study is to explore how IoT can be applied to build a reliable, efficient, and transparent food traceability system that ensures food quality, improves safety, and increases consumer confidence. The system integrates IoT devices such as sensors, RFID tags, GPS trackers, and cloud platforms. These tools continuously collect data on critical parameters including temperature, humidity, location, and handling conditions. The information is then transmitted and stored in a secure database, where block chain technology may also be applied to ensure data integrity and traceability. The proposed IoT-driven system enables real-time visibility of food movement from farm to fork. It allows early detection of safety risks, quick product recalls, and improved regulatory compliance. By ensuring accurate, real-time, and tamper-proof information flow, they can revolutionize food supply chain management, protect public health, and build long-term consumer trust.

Keywords: Food traceability, Food safety, Consumer trust, Farm to fork

FOOD SPOILAGE DETECTION SYSTEM USING IoT

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Abstract: Food spoilage and inefficient waste management are pressing global concerns, impacting both public health and environmental sustainability. This project proposes an innovative IoT-based Food Spoilage Detection and Waste Management System that monitors food freshness in real-time and provides proactive alerts to reduce foodborne risks and minimize wastage. The system leverages sensors such as MQ-135 (gas), DHT11 (temperature and humidity), and a NodeMCU microcontroller, integrated with a mobile application to track environmental parameters in food storage units. When gases like methane or ethanol exceed safe thresholds, the system alerts users and activates a UV sterilization unit, extending the edibility of perishable items. Notifications are sent via the app to guide users through the sterilization process. This smart system emphasizes key factors influencing food decay temperature, humidity, and gas emissions offering a practical solution for homes, food businesses, and supply chains. With critical thresholds based on food safety guidelines (e.g., danger zone between 40°F–140°F for bacterial growth), the system ensures that food is stored and consumed safely.

Keywords: IoT, Food Spoilage Detection, Waste Management, Gas Sensor

IoT ENABLED SMART 3D FOOD PRINTING FOR PERSONALISED NUTRITION AND FOOD DESIGN

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Abstract: The integration of the Internet of Things (IoT) with 3D food printing technology has emerged as a revolutionary approach to achieving personalized nutrition and advanced food design. 3D food printing enables the layer-by-layer fabrication of customized meals with controlled shapes, textures, flavors, and nutritional profiles. When combined with IoT, this technology becomes more intelligent and adaptive, as health data from wearable devices, smart sensors, and cloud-based nutritional databases can be analyzed in real time to design foods tailored to individual dietary needs and preferences. Such systems can recommend and automatically print meals that address specific health conditions, including diabetes, obesity, and malnutrition, while also supporting elderly nutrition and clinical dietary management. Beyond healthcare, IoT-enabled smart food printing also opens new opportunities in gastronomy, where creativity, personalization, and consumer engagement are highly valued. Furthermore, it supports sustainability by reducing food waste, optimizing resource use, and enabling alternative protein incorporation. The synergy between IoT and 3D printing thus addresses both global health and food system challenges. By bridging technology, health, and design

Keywords: *IoT, 3D food printing, personalized nutrition, smart food design, healthcare, food innovation, dietary customization, digital gastronomy*

AI-CHATBOT FOR DAY-TO-DAY NUTRITION GOALS

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Abstract: In today’s fast-paced lifestyle, maintaining balanced nutrition is a challenge for many individuals. Artificial Intelligence (AI) offers innovative solutions through chatbot technology, providing personalized dietary guidance and real-time support. An AI-powered nutrition chatbot can assist users with daily meal planning, calorie tracking, portion control, and healthy food choices based on personal preferences, age, activity level, and health conditions. Unlike static diet charts, the chatbot interacts with users dynamically, adapting recommendations to lifestyle changes and monitoring progress. Furthermore, it can address common nutrition-related queries, promote awareness of balanced diets, and encourage healthy eating habits in an engaging and accessible manner. By combining AI, natural language processing, and nutritional science, such a system can serve as a virtual dietitian, helping individuals make informed decisions for improved health and well-being.

Keywords: *AI, Chatbot, Nutrition, Personalized Diet, Health Monitoring, Meal Planning*

AI MODEL-BASED WASTE SEGREGATION MONITORING SYSTEM FOR URBAN LOCAL BODIES

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Abstract: Urban waste management remains a growing challenge for local bodies, with improper segregation leading to environmental degradation, higher processing costs, and inefficiencies in recycling systems. This paper presents an intelligent waste segregation monitoring system powered by an ARIMA (AutoRegressive Integrated Moving Average) time series forecasting model, designed specifically for Urban Local Bodies (ULBs). The system employs IoT-enabled smart bins to collect real-time data on waste quantity and type across multiple collection points. Using historical waste generation patterns, the ARIMA model forecasts future waste trends, enabling authorities to plan optimized collection schedules, resource allocation, and segregation awareness programs. The integration of forecasting with IoT infrastructure enhances decision-making, reduces overflow incidents, and improves compliance with waste segregation norms. Experimental results from urban pilot deployments show that the system effectively anticipates waste surges and supports proactive interventions. This approach offers a scalable and data-driven solution to modernize urban waste management and promote sustainable city practices.

Keywords: ARIMA, Waste Segregation, Urban Local Bodies, IoT, Smart Waste Management, Time Series Forecasting, Solid Waste, Smart City Solutions

DATA-ENHANCED PLA PRODUCTION FROM CHEESE WHEY AND FRUIT PEELS USING AI-ASSISTED FERMENTATION

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Abstract: Polylactic acid (PLA) is a biodegradable polymer gaining attention as a sustainable substitute for petroleum-based plastics. This study explores the use of cheese whey and fruit peel waste as economical substrates for lactic acid fermentation, achieving dual waste valorization. A critical challenge is optimizing fermentation parameters such as pH, temperature, agitation, and substrate ratios, which significantly impact lactic acid production. To tackle this, Artificial Intelligence (AI) and Machine Learning (ML) models are integrated to predict and optimize fermentation outcomes. Training these models on both experimental and simulated data enables precise control and dosage recommendations during fermentation, minimizing trial-and-error, enhancing yield, and reducing processing time. This innovative approach highlights a sustainable and intelligent route for PLA production, merging environmental benefits with advanced computational technology for potential industrial scalability.

Keywords: fruit peel waste, lactic acid fermentation, artificial intelligence, machine learning, waste valorization

APPLICATION OF MACHINE LEARNING FOR ANALYSIS AND OPTIMIZATION OF TASTE AND TEXTURE IN FOOD TECHNOLOGY

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Abstract: This study investigates the use of machine learning (ML) to analyze and optimize taste and texture in food technology. By processing diverse datasets including chemical compositions, sensory evaluations, and physical properties, ML models like neural networks and support vector machines identify critical factors affecting sensory qualities such as flavor, firmness, and mouthfeel. The approach accurately predicts consumer preferences and simulates texture profiles, enabling the development of food products tailored to specific sensory targets. ML reduces dependence on traditional sensory panels, accelerates innovation, and supports personalized nutrition by customizing food attributes to individual needs. Integrating ML with food science bridges the gap between objective data and subjective sensory experiences, providing valuable insights to improve product quality, consistency, and consumer satisfaction.

Keywords: machine learning, taste analysis, texture optimization, food technology, sensory evaluation, neural networks, flavor profiling, consumer preference prediction

IoT-BASED AUTOMATED QUALITY GRADING SYSTEM FOR FRUITS AND VEGETABLES

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Abstract: The increasing demand for fresh, high-quality fruits and vegetables necessitates the adoption of reliable and efficient grading systems. Traditional manual grading methods are labor-intensive, subjective, and inconsistent, often leading to post-harvest losses and reduced market value. An IoT-based automated quality grading system provides an intelligent and scalable solution to these challenges. The proposed system employs image sensors, color and texture analyzers, and other IoT-enabled devices to capture real-time data regarding size, shape, color, ripeness, and defects of fruits and vegetables. This data is processed using microcontrollers and transmitted via IoT protocols to cloud platforms, where machine learning algorithms perform classification and grading with high accuracy. The results are made accessible to farmers, distributors, and retailers through mobile and web applications, enabling informed decision-making across the supply chain. The system enhances transparency, ensures standardized quality assessment, and minimizes human error while significantly reducing post-harvest losses.

Keywords: IoT, Smart Agriculture, Automated Grading, Fruits and Vegetables, Quality Assessment, Machine Learning, Post-Harvest Management

IoT BASED SMART COOKING OIL MONITORING AND CONTROL

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Abstract: Cooking oil is a widely used consumable in households, restaurants, and food industries. However, repeated use of oil beyond safe limits leads to harmful compounds that adversely affect human health. Traditional monitoring methods rely on manual checks, which are inefficient and inaccurate. To address this, the proposed project introduces an IoT-based Smart Cooking Oil Monitoring and Control System that ensures oil quality and safety in real time. The system integrates sensors to measure vital parameters such as temperature, viscosity, and Total Polar Compounds (TPC) of the cooking oil. The collected data is processed by a microcontroller and transmitted to a cloud platform via Wi-Fi for real-time monitoring. Users can access oil quality status through a mobile or web application with timely alerts when the oil crosses permissible thresholds. Additionally, the system includes an automatic control mechanism to stop further usage of degraded oil, ensuring safety and compliance with food standards. This solution enhances food safety, reduces health risks, minimizes wastage, and promotes efficient oil usage, making it highly beneficial for households and commercial kitchens alike.

Keywords: IoT, Cooking Oil Quality, Real-Time Monitoring, Food Safety, Smart Control System

MACHINE LEARNING - DRIVEN FLAVOR PROFILING AND CUSTOMIZATION AN FOOD TECHNOLOGY

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Abstract: Integrating Artificial Intelligence into food science is expanding the scope of personalized nutrition. There is a potential for consumer-centric product development. In this work, we propose the creation of an Indian Regional Flavor Atlas, which will be based on machine learning for flavor profiling and customization. Indian cuisine is different from the global databases. Indian cuisine offers variations from region to region, diverse flavor combinations, and multiple complex layers of flavor pairing that, when it comes to our dataset, are poorly represented. Our proposed approach is to gather regionally diverse recipes and ingredients, molecular flavor mapping (FlavorDB and FooDB), and building chemical, cognitive, and socio-cultural predictive models around the perception of flavor. The creation of the first Indian Regional Flavor Atlas is an important addition to the Indian computational gastronomy and applied food technology landscape, as is the use of multimodal machine learning to improve the precision of flavor forecasting and the creation of an interactive system for custom flavor creation

Keywords: AI, computational gastronomy, flavor Atlas, multimodal machine learning, custom nutrition, Indian food, flavor, food technology.

LINEAR REGRESSION MODELS FOR IoT-ENABLED MILK CONTAINER SPOILAGE ALARM

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Abstract: Milk spoilage poses a significant challenge in the dairy supply chain and household management, often leading to health risks and economic losses. This study proposes an IoT-enabled milk container system equipped with sensors to monitor key spoilage indicators such as temperature, pH, and time. Using linear regression models, the system predicts the spoilage timeline based on real-time sensor data, enabling early detection and alert generation. The linear regression approach offers a simple yet effective predictive model that estimates milk freshness by correlating sensor measurements with spoilage progression. Alerts are communicated to users through a connected application, promoting timely consumption or disposal to prevent health hazards. Experimental validation demonstrates that the model provides accurate spoilage predictions, ensuring enhanced food safety and reducing milk wastage. The integration of IoT and linear regression thus offers a cost-effective and practical solution for real-time monitoring of perishable dairy products.

Keywords: *Internet of Things (IoT), Linear Regression, Milk Spoilage, Predictive Modeling, Spoilage Alarm, Food Safety, Smart Container, Sensor Monitoring*

FERMENTATION MASTERY: A CONTROLLED APPROACH

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Abstract: Fermentation is one of humanity’s oldest and most enduring biotechnological practices, transforming raw agricultural substrates into nutritionally enriched, shelf-stable, and sensorial diverse food and beverage products. Once dependent on spontaneous and empirical methods, fermentation has evolved into a science-driven discipline that integrates microbiology, biochemistry, engineering, and data-driven technologies. This shift from traditional practices to controlled processes has enhanced product consistency, safety, and efficiency while expanding applications in food, pharmaceuticals, bio-fuels, and environmental sustainability. Advances in microbial strain engineering, process optimization, and omics-based monitoring tools now enable unprecedented precision in regulating fermentation parameters. At the same time, sustainable strategies such as valorising agro-industrial by products and adopting circular bio economy approaches are redefining its ecological role. This review highlights the historical evolution, technological innovations, and interdisciplinary applications of fermentation, with an emphasis on future directions including smart fermentation systems, artificial intelligence integration, and personalized nutrition. By bridging traditional knowledge with cutting-edge innovations, fermentation mastery is positioned as a key solution to global challenges in food security, health, sustainability, and industrial resilience.

Keywords: *Fermentation, Process Optimization, Monitoring Tools, Microbial Strain, Cloud computing*

ECOSENSE PACKAGING: SMART IoT FOR MEAT FREASHNESS

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Abstract: The rising concern about plastic waste and food safety has encouraged the search for biodegradable packaging for meat and poultry. Conventional plastic, while useful in keeping food fresh, causes serious environmental problems. Natural materials such as chitosan, cellulose, starch, polylactic acid (PLA), and polyhydroxy alkanoates (PHAs) are being studied as eco-friendly alternatives because they can form films, are biodegradable, and can be combined with smart packaging systems. To improve their strength and ability to block moisture and oxygen, researchers use additives like. Natural antimicrobials, and multilayer designs. In addition, “active packaging” includes antimicrobial agents and absorbent pads to slow spoilage, while “intelligent packaging” uses natural color indicators (such as anthocyanins from red cabbage) or simple sensors to show changes in freshness by detecting gases like amines released during spoilage. Some modern systems even link with smart phones or Internet of Things (IoT) technologies for real-time freshness monitoring. This review highlights the latest developments in biodegradable packaging for meat and poultry, discussing materials, smart features, safety, and future challenges. The study concludes that large-scale production, lower costs, and proper safety checks are needed.

Keywords: Biodegradable Packaging, Meat and Poultry, Chitosan, PLA, PHAs, Active Packaging, Intelligent Packaging, Freshness Indicators, Biosensors, IoT, Sustainability

AI AND IoT ENABLED ONION SHELF LIFE INCREASING SYSTEM

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Abstract: This AI- and IoT-enabled system significantly enhances the shelf life of onions by continuously monitoring storage conditions and detecting early signs of spoilage. The system integrates AI-powered cameras, gas sensors, and temperature and humidity monitors to collect real-time data on environmental factors affecting onion quality. Advanced AI algorithms analyze visual and sensor data to detect sprouting and rot, while gas sensors identify spoilage-related emissions like methane. Instant alerts are sent to farmers via mobile applications, allowing prompt segregation and removal of compromised onions. Automated environmental controls optimize storage conditions to minimize degradation. Data is securely stored and processed on cloud platforms, supporting comprehensive analysis for informed decision-making and reducing post-harvest losses. This smart storage solution improves product quality, supports sustainable agriculture, and boosts economic benefits by preventing spoilage during storage and transportation.

Keywords: AI cameras, Internet of Things, machine learning, onion shelf life extension, spoilage detection, real-time monitoring

AI & POWER COMPUTING FOR INSTANT FOOD SAFETY MONITORING

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Abstract: Food spoilage and adulteration remain major challenges in the food industry, leading to health risks and economic losses. Traditional laboratory methods for quality testing are time-consuming and fail to provide instant results. This project proposes an AI-driven, power computing-based system for real-time food safety monitoring. Using datasets of milk and juice spoilage indicators such as pH, temperature, microbial counts, and spectral data, the system applies machine learning models to classify products as “Safe” or “Spoiled.” High performance computing enables rapid processing of large datasets, ensuring faster and more accurate predictions. The prototype includes a simple dashboard interface with color-coded outputs for instant decision-making. This approach minimizes food waste, enhances consumer safety, and provides industries with a cost-effective solution for quality assurance. Future expansion includes IoT sensor integration and block chain for traceability.

Keywords: Artificial Intelligence, Machine Learning, Power Computing, Food Safety, Real-Time Monitoring, Spoilage Prediction, Quality Assurance.

CRISIS RESILIENT COLD CHAIN SYSTEM FOR MEDICINE AND PERMISSIBLE AID

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Abstract: In conflict-affected regions such as Palestine, maintaining the integrity of perishable food supplies and life-saving medicines is a critical humanitarian challenge. Breakdowns in the cold chain due to damaged infrastructure, transport delays, and unreliable power lead to spoilage, wastage, and severe risks to public health. This project proposes the design and development of an IoT-based crisis-resilient cold chain monitoring system that ensures safe storage and distribution of temperature-sensitive commodities. The system integrates low-cost temperature, humidity, and GPS sensors with an ESP32-based controller connected to GSM/LoRa networks for real-time data transmission. Data is visualized on a cloud dashboard, providing live shipment tracking, automated alerts for temperature excursions, and predictive insights into shelf-life risks. Power resilience is achieved through solar-charged battery packs and phase-change cooling inserts. By enabling early detection of cold chain failures and supporting rapid decision-making, the proposed solution minimizes spoilage, enhances transparency in humanitarian logistics, and safeguards the nutritional and medical needs of vulnerable populations in war-affected zones.

Keywords: IoT (Internet of Things) Cold chain, Perishable food monitoring, Medicine storage.

ARTIFICIAL NEURAL NETWORK-BASED MACHINE LEARNING FOR SMART WATER REMINDER IN FOOD PREPARATION

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Abstract: Efficient water usage is essential in food preparation to promote sustainability and reduce waste. This paper presents a smart water reminder system powered by Artificial Neural Network (ANN) based machine learning to assist users in optimizing water consumption during cooking processes. The system leverages IoT-enabled sensors to monitor key parameters such as food type, quantity, and cooking stage in real time. An ANN model is trained to analyze these inputs and predict the optimal amount of water required for different recipes and cooking conditions. The system provides timely reminders and recommendations to users, helping to avoid overuse or underuse of water, thereby improving resource efficiency. The model's adaptability and learning capability enable personalized water usage advice based on user habits and preferences. Experimental results demonstrate that the ANN-driven system delivers accurate predictions and practical usability, making it a valuable tool for smart kitchens and sustainable cooking practices.

Keywords: Artificial Neural Network (ANN), Machine Learning, Smart Water Reminder, Food Preparation, Internet of Things (IoT), Water Conservation, Smart Kitchen, Resource Efficiency

NEXT-GEN ONION STORAGE SYSTEMS FOR SUSTAINABLE SHELF-LIFE ENHANCEMENT

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Abstract: Onions, being a staple vegetable, are highly prone to post-harvest losses due to poor storage conditions, microbial attacks, and excess moisture. Traditional storage practices often fail to regulate temperature, humidity and ventilation, leading to rapid spoilage and wastage of 30–40% of the produce. To overcome these limitations, this project introduces an IoT-based smart onion storage system that integrates modern monitoring technology with natural preservation techniques. The proposed system uses a ventilated storage structure with onions stored in stacked plastic crates on a raised platform. Sensors monitor temperature, humidity, and gas levels, while IoT controllers (Arduino/ESP32) send real-time alerts to smart phones for corrective action. Exhaust fans improve airflow, and natural agents such as turmeric powder and dried neem leaves act as microbial inhibitors. By combining technology with ecofriendly solutions, the system extends onion shelflife to 4–5 months, offering a sustainable and cost-effective alternative to conventional storage methods.

Keywords: Onion storage, IoT monitoring, natural preservatives.

DEEP LEARNING -DRIVEN NUTRITIONAL ANALYSIS FOR PERSONALIZED FOOD IMAGES

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Abstract: Deep learning has revolutionized nutritional analysis by allowing rapid, non-destructive assessment of customized food images. Utilizing architectures such as convolutional neural networks (CNNs) and transformer-based models, these systems can automate food identification, portion size estimation, and prediction of macronutrient content from diverse image inputs. Integrating visual features with nutrition databases enables personalized diet management and enhances health monitoring. Advanced data augmentation and transfer learning improve generalization to new food types, addressing challenges due to intra-class variability and visual similarity between dishes. This approach offers significant advantages over traditional methods by reducing manual input and improving scalability and accuracy. Applications include individualized dietary tracking, real-time calorie estimation, and support for dietary interventions, making deep learning a cornerstone for modern, personalized nutrition solutions.

Keywords: Deep learning, food image analysis, nutritional assessment, CNN, personalized nutrition, macronutrient estimation, dietary management.

DEVELOPMENT OF ETHYLENE DETECTOR TO AVOID BANANA SPOILAGE USING RECENT TECHNIQUES

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Abstract: The spoilage of bananas during transportation and storage, primarily due to the production of ethylene gas, presents a significant challenge to the agricultural and logistics industries, leading to substantial economic losses. This paper presents the development of a real-time, IoT-based ethylene detection system designed to monitor and mitigate banana spoilage. The system utilizes a low-cost electrochemical ethylene sensor integrated with a microcontroller and a Wi-Fi module. These methods are reactive, subjective, and fail to capture the chemical trigger of spoilage. While high-end gas chromatography systems offer accurate ethylene measurement, they are expensive, bulky, and unsuitable for continuous, distributed monitoring within transportation containers or storage facilities. This paper addresses this gap by proposing and validating a low-cost, real-time, IoT-based ethylene detection system. The objective is to provide an accessible, proactive tool for smart cold chain management, shifting from reactive spoilage identification to preventative ripening control, thereby maximizing shelf life and reducing food waste.

Keywords: Ethylene detector, Banana spoilage, IoT, Food waste, Smart monitoring, Sensors.

DEEP LEARNING AND AI-DRIVEN INNOVATIONS FOR PREDICTIVE FOOD WASTE REDUCTION AND REAL-TIME SUPPLY CHAIN MONITORING

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Abstract: Deep learning has revolutionized nutritional analysis by allowing rapid, non-destructive assessment of customized food images. Utilizing architectures such as convolutional neural networks (CNNs) and transformer-based models, these systems can automate food identification, portion size estimation, and prediction of macronutrient content from diverse image inputs. Integrating visual features with nutrition databases enables personalized diet management and enhances health monitoring. Advanced data augmentation and transfer learning improve generalization to new food types, addressing challenges due to intra-class variability and visual similarity between dishes. This approach offers significant advantages over traditional methods by reducing manual input and improving scalability and accuracy. Applications include individualized dietary tracking, real-time calorie estimation, and support for dietary interventions, making deep learning a cornerstone for modern, personalized nutrition solutions.

Keywords: Deep learning, food image analysis, nutritional assessment, CNN, personalized nutrition, macronutrient estimation, dietary management.

REAL TIME TURBIDITY MONITORING SYSTEM

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Abstract: This project presents the design and development of a real-time turbidity monitoring system for water quality assessment. The main objective is to provide a low-cost, accurate, and continuous method to measure turbidity levels in water, which is a key indicator of contamination. A turbidity sensor was integrated with a microcontroller and connected to the arduino platform for real-time data acquisition and transmission. The collected data is displayed on a cloud-based dashboard, enabling users to monitor water clarity remotely through mobile or web applications. Alert notifications are generated when turbidity values exceed safe limits, ensuring timely corrective action. The system was tested with different water samples, and the results confirmed reliable turbidity detection with quick response time. This innovation can be applied in industries, municipal water supply systems, and environmental monitoring, offering an efficient solution for maintaining safe water quality and supporting sustainable water management.

KEYWORDS : cloud-based, microcontroller

MACHINE LEARNING FOR FOOD QUALITY AND SAFETY PREDICTION: A DATA-DRIVEN APPROACH

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Abstract: Food quality and safety are critical concerns in the food industry, with significant implications for public health and economic losses. This project proposes a machine learning-based approach to predict food quality and safety by analyzing various parameters such as temperature, humidity, pH, and microbial contamination. By leveraging advanced data analytics and machine learning algorithms, our system can identify patterns and anomalies in food production, processing, and storage, enabling early detection of potential safety risks. The system can also predict the likelihood of food spoilage and contamination, allowing for proactive measures to prevent foodborne illnesses. Our approach has the potential to revolutionize food quality and safety monitoring, enabling the food industry to make data-driven decisions and improve overall food safety standards. The system can be integrated into existing food supply chains, providing real-time insights and alerts to ensure safe and quality food products. By leveraging machine learning, we can reduce food waste, improve public health, and enhance the efficiency of the food industry.

Keywords: Food quality, food safety, machine learning, predictive analytics

SMART IoT-ENABLED PEST DETECTION AND CONTROL SYSTEM FOR TOMATO CROP PROTECTION

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Abstract: Tomato crops are highly vulnerable to pest infestations that cause substantial yield and economic losses in agriculture. Conventional pest management approaches are frequently reactive, resulting in delayed intervention and excessive use of pesticides. This paper proposes a smart IoT-enabled pest detection and control system specifically designed for tomato crop protection. The system integrates a network of high-resolution cameras, acoustic sensors, and environmental measuring devices (temperature, humidity, and CO₂) distributed across the crop field. Edge computing devices process sensor data in real time, employing advanced machine learning models for precise identification of key tomato pests such as Tutaabsoluta and aphids. Comprehensive field validation demonstrated enhanced early pest detection rates, greater sustainability through reduction of pesticide input, and a measurable improvement in crop health and productivity when compared with conventional practices. The proposed IoT solution demonstrates significant promise for scalable, data-driven, and environmentally conscious pest management in tomato cultivation, advancing the outlook for precision agriculture and food security.

Keywords: IOT, tomato crops, pest detection, smart agriculture, edge computing, machine learning, Sustainable farming

ENVIRONMENTAL MONITORING SYSTEM FOR FOOD QUALITY PRESERVATION

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Abstract: An Environmental Monitoring System (EMS) for food quality preservation is a technology-driven solution that ensures safe storage and handling of food products. It continuously tracks key environmental factors such as temperature, humidity, air quality, and light exposure within storage and transportation facilities. By using sensors and IoT-based devices, the system collects real-time data and alerts operators to deviations from safe ranges, preventing spoilage and contamination. This is especially vital for perishable items like dairy, meat, fruits, and vegetables, which require precise environmental control to maintain freshness and nutritional value. The EMS helps in maintaining regulatory compliance with food safety standards such as HACCP and ISO, while also reducing waste and operational costs. With cloud integration, the system provides remote monitoring, data logging, and predictive analytics, enabling better decision-making. Overall, an EMS ensures food quality, extends shelf life, and safeguards consumer health through proactive environmental control.

Keywords: *Environmental Monitoring System (EMS), Food Quality Preservation, IoT-based devices, Real-time tracking, Food Safety, HACCP, ISO compliance, Predictive analytics, Cloud integration.*

SMART FRIDGE MONITOR WITH RECIPE SUGGESTIONS

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Abstract: This project aims to develop a smart fridge monitor that tracks the contents of a refrigerator and alerts users when items are near expiration or running low. The system utilizes image recognition, weight sensors, and barcode scanning to identify and track food items. Based on the available ingredients, the system suggests recipes to users, promoting meal planning, reducing food waste, and enhancing cooking creativity. The smart fridge monitor integrates with a user-friendly interface, providing a seamless experience for users to manage their fridge contents and explore new recipes.

Keywords: *Smart Fridge, Food Tracking, Recipe Suggestions*

ADULTERANT DETECTION IN DAIRY BASED PRODUCTS

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Abstract: An adulterant is a substance added to food products to increase quantity or reduce cost but which lowers quality, safety, or nutrition. Common adulterants in milk and dairy are water, starch, detergent, urea, formalin, synthetic milk, and neutralizers. IoT-enabled sensors can continuously monitor milk quality parameters like pH, conductivity, fat content, and temperature, which indicate adulteration. Sensors → collect milk quality data → IoT device transmits data → cloud/AI analysis → adulteration alerts. IoT systems enable real-time detection, automated quality checks, and immediate rejection of adulterated batches, ensuring consumer safety. Data from sensors (pH, turbidity, conductivity, NIR, biosensors) help detect deviations, confirm adulteration, and generate reports for quality assurance.

Keywords: Dairy products, Food adulteration, Milk safety, Adulterant detection, Food authenticity, Analytical techniques, Biosensors, Spectroscopy, Food quality, Public health.

AIAND IoT ENABLED ONION SHELF-LIFE INCREASING SYSTEM

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Abstract: AI- and IoT-enabled system significantly enhances the shelf life of onions by continuously monitoring storage conditions and detecting early signs of spoilage. The system integrates AI-powered cameras, gas sensors, and temperature and humidity monitors to collect real-time data on environmental factors affecting onion quality. Advanced AI algorithms analyze visual and sensor data to detect sprouting and rot, while gas sensors identify spoilage-related emissions like methane. Instant alerts are sent to farmers via mobile applications, allowing prompt segregation and removal of compromised onions. Automated environmental controls optimize storage conditions to minimize degradation. Data is securely stored and processed on cloud platforms, supporting comprehensive analysis for informed decision-making and reducing post-harvest losses. This smart storage solution improves product quality, supports sustainable agriculture, and boosts economic benefits by preventing spoilage during storage and transportation.

Keywords: AI cameras, Internet of Things, machine learning, onion shelf-life extension, spoilage detection, real-time monitoring, gas sensors, temperature and humidity control, smart storage, post-harvest loss reduction, sustainable agriculture.

AI MODEL FOR PREDICTIVE MONITORING OF GRAIN GERMINATION

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Abstract: The spoilage of bananas during transportation and storage, primarily due to the production of ethylene gas, presents a significant challenge to the agricultural and logistics industries, leading to substantial economic losses. This paper presents the development of a real-time, IoT-based ethylene detection system designed to monitor and mitigate banana spoilage. The system utilizes a low-cost electrochemical ethylene sensor integrated with a microcontroller and a Wi-Fi module. The sensor continuously measures ethylene concentration, and the data is transmitted wirelessly to a cloud-based platform. Real-time alerts and notifications are generated on a mobile application when ethylene levels exceed a predefined threshold, enabling timely intervention such as ventilation or refrigeration. This system provides a cost-effective and efficient solution for farmers, distributors, and retailers to proactively manage the ripening process, extend the shelf life of bananas, and significantly reduce food waste. This paper addresses this gap by proposing and validating a low-cost, real-time, IoT-based ethylene detection system. The objective is to provide an accessible, proactive tool for smart cold chain management, shifting from reactive spoilage identification to preventative ripening control, thereby maximizing shelf life and reducing food waste.

Keywords: Ethylene detector, Banana spoilage, IoT, Food waste, Smart monitoring, Sensors.

AI PLATE MATE: INSTANT NUTRITIONAL ANALYSIS WITH COMPUTER VISION

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Abstract: This project introduces an innovative, non-invasive system for automated food component analysis using Artificial Intelligence (AI) and Computer Vision (CV). The objective is to accurately identify, segment, and quantify individual food components within a complex dish from a single image capture. We leverage Deep Learning (DL), specifically a combination of Instance Segmentation (e.g., Mask R-CNN or YOLO-based models) and Transfer Learning, to achieve high-fidelity recognition of diverse ingredients. The system performs two key functions: (1) Semantic Segmentation to isolate the boundaries of each food item (e.g., rice, chicken, vegetables). The proposed analyzer offers a scalable, accurate, and user-friendly solution for applications in diet monitoring, food waste management, and quality control in commercial food services.

Keywords: Artificial Intelligence (AI), Computer Vision (CV), Deep Learning (DL), Instance Segmentation, Food Recognition and Nutritional Analysis

SUPPORT VECTOR MACHINE-BASED MACHINE LEARNING FOR POCKET IOT ADULTERATION DETECTION SYSTEM

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Abstract: Food adulteration poses serious health risks and challenges for quality control, particularly in resource-limited settings. This paper presents a compact, portable IoT-based adulteration detection system empowered by Support Vector Machine (SVM) algorithms for rapid and reliable identification of food contaminants. The system utilizes miniaturized sensors to capture relevant chemical and physical signatures of food samples in real-time. SVMs are employed due to their effectiveness in handling high-dimensional data and their strong generalization capabilities for binary and multi-class classification problems. The trained model accurately discriminates between pure and adulterated samples, enabling immediate alerts through a user-friendly mobile interface. The pocket-sized design ensures convenience and accessibility for consumers, vendors, and regulatory bodies. Experimental results validate the system’s high detection accuracy, robustness, and low false positive rate, demonstrating its potential as an effective tool for food safety assurance in everyday environments.

Keywords: Support Vector Machine (SVM), Internet of Things (IoT), Food Adulteration Detection, Portable Device, Machine Learning, Real-Time Monitoring

AI-POWERED SMART FOOD SAVER USING IoT FOR FOOD FRESHNESS MONITORING

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Abstract: This project introduces an innovative, non-invasive system for automated food component analysis using Artificial Intelligence (AI) and Computer Vision (CV). The objective is to accurately identify, segment, and quantify individual food components within a complex dish from a single image capture. The system performs two key functions: (1) Semantic Segmentation to isolate the boundaries of each food item (e.g., rice, chicken, vegetables) and (2) Portion Size Estimation by integrating visual data with a depth-sensing mechanism (or a calibrated reference object) to approximate the volume and, subsequently, the mass/weight of the component. The proposed analyzer offers a scalable, accurate, and user-friendly solution for applications in diet monitoring, food waste management, and quality control in commercial food services.

Keywords: Artificial Intelligence (AI), Computer Vision (CV), Deep Learning (DL), Instance Segmentation, Food Recognition and Nutritional Analysis

HARNESSING ARTIFICIAL INTELLIGENCE FOR SMART AGRICULTURE: ENHANCING PRODUCTIVITY, SUSTAINABILITY, AND PRECISION FARMING

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Abstract: The integration of Artificial Intelligence (AI) in agriculture has ushered in a new era of smart farming, where data-driven decision-making and automation are transforming traditional agricultural practices. This paper explores the current landscape, applications, and future prospects of AI technologies in smart agriculture. It examines how machine learning, computer vision, and IoT-enabled systems contribute to precision farming, crop monitoring, disease detection, yield prediction, and resource optimization. Furthermore, the paper highlights the benefits of AI-driven approaches in improving sustainability, reducing environmental impact, and addressing labor shortages. Challenges such as data availability, cost, and technological adoption barriers in rural areas are also discussed. The study concludes by emphasizing the need for interdisciplinary collaboration and policy support to realize the full potential of AI in agriculture.

Keywords: Smart Agriculture, Artificial Intelligence, Precision Farming, Machine Learning, Crop Monitoring, Yield Prediction

SMART MILK PACK: COLOR-BASED EXPIRY INDICATING SMART PACKAGING FOR DAIRY SAFETY AND SUSTAINABILITY

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Abstract: Milk is one of the most widely consumed and nutritionally essential food products, yet it is also highly perishable and prone to microbial spoilage. Conventional milk packaging provides only a printed expiry date, which assumes ideal storage conditions and often fails to reflect the product's true freshness. The system is based on a food-safe sensor strip responsive to biochemical changes in milk, particularly pH shifts and spoilage-related gas release. As the milk progresses from fresh to spoiled, the strip undergoes a visible color transition. This not only enhances consumer safety but also promotes transparency, quality assurance, and trust in the dairy industry. Overall, the proposed innovation combines food technology, smart packaging, and IoT solutions to create a sustainable and consumer-friendly approach that ensures safe consumption, minimizes wastage, and contributes to improved efficiency in the dairy supply chain.

Keywords: Smart packaging, Milk freshness indicator, Food spoilage detection, IoT in dairy, Color-based expiry alert

DEEP LEARNING TECHNOLOGIES FOR ENHANCING FOOD SAFETY AND QUALITY CONTROL

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Abstract: Ensuring food safety and quality is critical for public health, supply-chain integrity, and reducing food waste. Recent advances in deep learning (DL) have enabled automated, accurate, and scalable solutions for inspection, contamination detection, spoilage prediction, and quality grading. This paper surveys DL-based technologies applied to food safety and quality control and presents an experimental pipeline combining hyperspectral imaging, RGB vision, and sensor fusion with convolutional neural networks (CNNs) and transformer models to detect microbial contamination, foreign objects, and quality defects in fresh produce. We describe dataset preparation, model architectures, training procedures, evaluation metrics, and deployment considerations for real-time production-line environments. Experiments on benchmark datasets and a curated multi-modal dataset show that the proposed pipeline achieves state-of-the-art detection and classification performance while meeting latency constraints for inline inspection. We discuss robustness, interpretability, cost–benefit trade-offs, and avenues for future research.

Keywords: Deep learning, food safety, quality control, hyperspectral imaging, object detection, transfer learning, model interpretability.

INTELLIGENT IOT-ENABLE FOOD DEHYDRATOR FOR SUSTAINABLE PRESERVATION

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Abstract: Fruits and vegetables are highly perishable due to their elevated moisture content, which accelerates microbial activity, nutrient degradation, and spoilage. Conventional drying techniques, such as sun drying, are widely practiced but often result in uneven dehydration, contamination, and loss of essential vitamins. To overcome these drawbacks, this project introduces an Intelligent Food Dehydrator capable of precise monitoring and control of moisture, size, and temperature to ensure safe and healthy preservation. The system employs an IoT enabled sensor network that continuously tracks critical parameters inside the drying chamber. This intelligent dehydrator extends the shelf life of perishable commodities, reduces dependency on chemical preservatives, and provides consumers with nutrient-rich, hygienically processed dried foods. By ensuring minimal energy usage and higher product quality, the system supports sustainable food processing and contributes to reducing post-harvest losses

Keywords: Food dehydration IoT, artificial intelligence, sensors, sustainable preservation, postharvest losses, smart food processing

AI-POWERED FOOD FRESHNESS DETECTOR

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Abstract: Food spoilage is a major global challenge, leading to significant food waste, economic loss, and health hazards. Traditional methods of detecting freshness rely on visual inspection, chemical tests, or expiration dates, which are often inaccurate or inefficient. With recent advancements in artificial intelligence (AI), machine learning (ML), and sensor technology, automated freshness detection has become feasible. This paper proposes an AI-powered food freshness detection system integrating computer vision, gas sensors, and deep learning algorithms. The model aims to classify food into categories such as fresh, moderately fresh, and spoiled with high accuracy. The system contributes toward enhancing food safety, reducing waste, and promoting sustainable consumption.

Keywords: IoT, artificial intelligence, sensors, sustainable preservation, postharvest losses, smart food processing

IOT BASED FOOD WASTE TRACKER

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Abstract: Food waste is a serious worldwide problem that has an impact on economic efficiency, food security, and environmental sustainability. In order to address this issue, this project suggests an Internet of Things-based food waste tracker that is intended to track, evaluate, and minimize food waste in commercial, industrial, and residential settings. Using smart sensors, weight scales, and image recognition modules built inside trash cans, the system uses Internet of Things (IoT) technology to gather data on food disposal in real time. These sensors monitor the amount, kind, and regularity of food waste. To find waste trends and produce useful insights, the devices' collected data is sent to a cloud-based platform for processing and analysis. The suggested remedy seeks to assist more general sustainability objectives while raising user awareness and accountability. The Internet of Things-based Food Waste Tracker promotes effective food management and behavioral change by automating food waste monitoring and offering insightful feedback. This system might be used in grocery shops, restaurants, hotels, and homes, helping to create a more intelligent and sustainable food ecology. All things considered, the use of IoT technology in food waste tracking offers a creative solution to one of the most important social and environmental problems of our day.

Keywords: cloud storage, microcontroller, load cell sensor, IoT, food waste management, smart kitchen, real-time monitoring, waste reduction, and sustainability

IOT BASED ON OIL QUALITY SENSOR

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Abstract: The rapid advancement of the Internet of Things (IoT) has opened up new opportunities for real-time monitoring and management across various industries. Among these applications, IoT-based oil quality monitoring plays a crucial role in ensuring the safety, efficiency, and longevity of engines, machines, and industrial equipment. Traditional methods of oil testing are often manual, time-consuming, and lack the ability to provide instant feedback, which can lead to unexpected breakdowns and costly maintenance. This approach not only improves predictive maintenance but also enhances decision-making by offering accurate insights into oil degradation trends. Furthermore, IoT-enabled oil quality monitoring contributes to sustainability by reducing oil wastage, lowering environmental impact, and optimizing resource usage. The integration of IoT in oil quality sensing represents a transformative step towards digitalization in maintenance practices, paving the way for smarter, cost-effective, and environmentally conscious operations. This paper highlights the design, functionality, and benefits of IoT-based oil quality sensors and their potential applications in automotive, industrial, and energy sectors.

Keywords: IoT, Oil Quality Sensor, Predictive Maintenance, Real-time Monitoring, Sustainability

DEVELOPMENT OF VINEGAR FROM UNDERUTILIZED TROPICAL FRUIT (*Syzygiumsamarangense*) BY SEQUENTIAL ALCOHOLIC AND ACIDIC FERMENTATION

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Abstract: *Syzygiumsamarangense* (Java apple, wax apple, or water apple) is an underutilized tropical fruit of the family *Myrtaceae*, characterized by high perishability and significant post-harvest losses despite its refreshing flavor and rich bioactive composition. This study addresses this gap by investigating the feasibility of producing vinegar from *S. samarangense* through conventional two-step fermentation: alcoholic fermentation with yeast followed by acetic acid fermentation with *Acetobacter spp.* The resulting vinegar will be assessed for physicochemical characteristics (pH, titratable acidity, residual alcohol), nutritional parameters (vitamin C, total polyphenols, antioxidant activity), microbiological safety, and sensory properties. The novelty of this research lies in valorizing a perishable, bioactive-rich fruit into a stable, functional food product with potential nutraceutical benefits. Thus, the project integrates food technology, sustainability, and functional innovation, contributing to both scientific advancement and socioeconomic development.

Keywords: *Syzygiumsamarangense*, vinegar, sequential fermentation, underutilized fruit, alcoholic fermentation, acetic fermentation, functional properties

PHYTOCHEMICAL EXTRACTION, SPECTRAL ANALYSIS, AND BIOLOGICAL ACTIVITIES OF YELLOW POINCIANA

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Abstract: A comprehensive review of the literature on *Peltophorumpterocarpum* (DC.) K. Heyne reveals that this species possesses remarkable pharmacological and physiological properties, along with diverse potential applications. The broad spectrum of biological activities associated with *P. pterocarpum* prompted the present investigation into its floral constituents for the isolation of novel bioactive compounds. In this study, an efficient protocol was developed for the extraction and isolation of compounds from the flowers of *P. pterocarpum*. Extraction was carried out using pure chloroform as the solvent in a Soxhlet apparatus operated at the solvent's boiling temperature. The isolated compound(s) were subsequently evaluated for antibacterial and antifungal activities against selected microbial species, using standard drugs as reference controls. The findings highlight the potential of *Peltophorumpterocarpum* flowers as a promising natural source of bioactive molecules with significant antimicrobial properties.

Keywords: *Peltophorumpterocarpum*; bioactive compounds; chloroform extraction; Soxhlet apparatus

INNOVATION IN THE DEVELOPMENT OF PROBIOTIC HERBAL ICE CREAM

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Abstract: The growing consumer demand for functional foods has created opportunities for the development of innovative products that combine health benefits with sensory appeal. This project focuses on the Innovation in the Development of Probiotic Herbal Ice Cream formulated using Aloe vera juice/pulp, natural colours (Beta-Carotene – 1%, 3% and 5% respectively), natural flavors (Vanilla- 0.1%, 0.3% and 0.5% respectively), and natural sweeteners (Honey – 10%, 20% and 30% respectively). The incorporation of *Lactobacillus acidophilus* and *Lactobacillus rhamnosus* GG (in combination 3%, 4% and 5% respectively) as a probiotic strain enhances the therapeutic value of the product by supporting gut health and improving immunity. The study evaluates the viability of probiotic cultures during processing and storage, the physicochemical and sensory properties of the ice cream, and its potential as a nutraceutical dessert. The outcome of this research highlights the feasibility of producing a novel, health-oriented frozen dairy product that combines herbal extracts and probiotics, thereby addressing the growing demand for value-added functional foods.

Keywords: Functional Dairy Product, Herbal Ice Cream, Probiotics, Nutritive Product and Human Health.

SUSTAINABLE REMOVAL OF SYNTHETIC DYES USING CORN COB-BASED ADSORBENT: AN EXPERIMENTAL STUDY

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Abstract: Corn cob, an abundantly available and cost-effective agricultural waste, was utilized as a natural adsorbent for the removal of malachite green dye from aqueous solutions. The main objective of this study was to investigate the adsorption of synthetic dye effluent using corn cob as a sustainable alternative to conventional chemical adsorbents, thereby minimizing environmental pollution. Batch adsorption experiments were conducted in the liquid phase to study the effects of adsorbent dosage, contact time, and particle size on dye removal efficiency. Dye samples were periodically collected, centrifuged, and analyzed using UV-Visible spectroscopy to determine the extent of adsorption. The results revealed that corn cob exhibited significant adsorption capacity, and the optimum conditions for maximum dye removal were established. This study demonstrates that corn cob can serve as an efficient, low-cost, and eco-friendly adsorbent for the treatment of dye-contaminated wastewater.

Keywords: Corn cob, Adsorption, Malachite green, UV analysis.

EXTRACTION OF KERATIN FROM WASTE BIOMASS OF HUMAN HAIR AND EGGSHELL FOR THE FABRICATION OF BIOPLASTIC

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Abstract: Plastic bags and plastic product, derived from petroleum-based high-density polyethylene, have become integral to modern lifestyles, leading to widespread environmental concerns due to their persistence in landfills. Plastic offers a variety of benefits, in a variety of shapes, such as sheets, panels, film, which can all be flexible as the application requires. Humans are also affected by plastic pollution, such as through the disruption of the thyroid hormone axis or hormone levels. This research successfully synthesized bio-plastics using keratin from human hair and eggshell samples. The addition of glycerol influenced the tensile strength and elongation at break, enabling control over these properties. Films with 2 wt% glycerol exhibited optimal mechanical and thermal characteristics, as well as homogeneous surfaces. SEM tests confirmed compatibility and absence of defects. These bio-plastics are biodegradable and offer a promising alternative to environmentally harmful fossil oil-based materials.

Keywords: Bioplastic, Keratin, Eggshell Waste, Homogeneous Surfaces, Tensile Strength.

CHOCODATE WHEY PROTEIN BAR

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Abstract: The main purpose of the product is nutrient-dense, convenient snacks for health-conscious consumers, combining high quality whey protein with natural sweetness from dates and added functional benefits from nuts and cocoa. This project aims to utilize whey, a major by-product of cheese and paneer production, for the development of whey protein bars, thereby reducing dairy industry wastage, minimizing environmental pollution, and converting waste into a value-added, nutritious product. Whey protein was selected as a high-quality protein source, while unsweetened cocoa powder and cinnamon powder were added to enhance flavour and provide antioxidant properties. Almond powder contributed healthy fats, fiber, and additional protein, while a small amount of salt was added for taste balance. \ The inclusion of dates improved sweetness, palatability, and textural integrity while also supplying essential micronutrients such as potassium, magnesium, and iron. Sensory evaluation indicated good consumer acceptability, with reduced bitterness from whey and cocoa and a pleasant balance of flavours. Overall, the formulated whey–date protein bar demonstrates potential as a clean-label, nutrient-dense snack that offers a healthier alternative to conventional protein bars by combining natural sweetness, high protein content, and functional health benefits.

Keywords: Whey Milk, Dates, Natural Sweetener, Nuts Fiber, Healthy Snacks.

O₂ LOCK BIOPOUCH

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Abstract: The increasing global focus on sustainable packaging has driven the development of biodegradable materials that minimize plastic waste while maintaining food quality. Butter, a high-fat dairy product, is particularly prone to oxidative rancidity, which adversely affects flavor, nutritional content, and overall quality. This study proposes a biodegradable dual-pouch system incorporating an oxygen scavenger to enhance storage stability and provide an eco-friendly packaging solution. The proposed system offers potential for broad application in premium and export-oriented dairy products, delivering both functional performance and sustainability benefits. This approach represents a significant advancement in reducing environmental impact while improving butter preservation through active biodegradable packaging. The study highlights the feasibility of combining biodegradable polymers with active oxygen-scavenging technology to create sustainable packaging solutions capable of maintaining product quality over time.

Keywords: Biodegradable packaging, Butter preservation, Oxygen scavenger, Polylactic Acid (PLA) , Lipid oxidation.

DESIGN AND DEVELOPMENT OF FULLY AUTOMATED NOVEL EGG HATCHING INCUBATOR

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Abstract: Artificial egg incubators are devices used to hatching the eggs by providing the required Conditions for fetus development inside the egg. Our cost-effective egg incubator system which provides adequate conditions for egg hatching and to meet the growing market needs for locally grown white meat at reasonable prices. A good temperature and humidity for standard egg hatching is between 37.4°C – 37.8°C, with humidity in the machine ranging from 60 – 65 %. The incubator is made up of plywood which is cost effective, xcluma XY- TR01 XY thermostat is ideal for controlling temperature and humidity accurately, 15 Watts incandescent bulb is used which consume less electricity and provide sufficient heat for hatching and incubating chamber consists of 1000 nos. of egg capacity. The synchronous motor which used in the incubator that turns the eggs to change their position in order to prevent the embryo from sticking to the shell. The eggs were turned automatically at 6 hours of interval.

Keywords: Low-Cost Incubator, Microcontroller, Tungsten bulb, Automatic Turner.

TURNING LEAF INTO NUTRITIOUS SUPPLEMENT FOR HUMAN

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Abstract: The growing demand for sustainable and nutrient-rich food sources has renewed scientific interest in plant-based supplements derived from agricultural and agroforestry by-products. This study investigates the valorization of edible and nutrient-dense leaves into nutritious supplements for human consumption, focusing on enhancing food security, reducing agricultural waste, and promoting circular bioeconomy practices. Selected leaves from high-protein, mineral-rich species such as *Moringa oleifera*, *Amaranthus spp.*, and *Cassia tora* were analyzed for proximate composition, phytochemical content, and antioxidant properties. The processing methodology includes controlled drying, fine milling, and microencapsulation to preserve heat-sensitive vitamins and bioactive compounds. Formulation trials incorporated the powdered leaf extract into functional foods and nutraceutical blends, assessing palatability, nutrient bioavailability, and shelf stability. The study establishes a sustainable model for converting underutilized plant biomass into value-added human health supplements, aligning with global goals on food security and resource-efficient nutrition.

Keywords: Leaf-based nutrition, Plant protein supplement, Bioactive compounds, Nutraceutical development, Food fortification, Circular bioeconomy, Sustainable nutrition.

DEVELOPMENT OF PORTABLE DEVICE FOR DETECTION & QUANTIFICATION OF ASPARTAME IN FOOD PRODUCTS

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Abstract: A portable device for the detection and quantification of artificial sweeteners, particularly aspartame, in food products is developed in this study. The device uses electrochemical and spectroscopic techniques to accurately measure sweetener content in real time. Aspartame, commonly found in diet sodas and sugar-free products, has been linked to health issues such as headaches, allergic reactions, heart disease, cancer and concerns over its long-term effects on the brain and metabolism. This portable device is designed for easy, on-site use, providing consumers and food industry professionals with an accessible method for monitoring sweetener levels. The device aims to improve public health awareness, support regulatory compliance, and facilitate better food safety practices. In addition, the study highlights the integration of cost-effective sensors and microcontrollers to ensure portability and user-friendliness. The findings emphasize the potential of this device as a reliable tool for routine food analysis and consumer protection.

Keywords: Aspartame, adulterant, artificial sweetener, public health awareness, Portable device, Food safety.

VALORIZATION OF FRUIT PEEL WASTE WITH NATURAL SPICES AND SAFFRON

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Abstract: Tea remains one of the most extensively consumed beverages globally, valued for its sensory appeal and diverse health-promoting properties. In recent years, the focus of research and industry has shifted toward the development of functional teas enriched with natural bioactive compounds. Concurrently, the growing concern over food waste has encouraged the exploration of sustainable utilization of fruit by-products. Fruit peels, in particular, are rich in flavonoids, limonoids, vitamin C, and dietary fibre, offering significant potential as functional ingredients. This study aims to develop a bioactive tea bag utilizing dried fruit peel waste in combination with saffron and its natural substitutes, such as safflower and turmeric. The formulation is designed to enhance antioxidant capacity while promoting the upcycling of agro-industrial waste. Such an approach aligns with the principles of sustainability and circular economy by converting waste materials into value-added nutraceutical products. The proposed concept bridges the gap between environmental management and functional beverage innovation. It offers a cost-effective and sustainable alternative to conventional teas, delivering enhanced antioxidant properties alongside sensory benefits. Overall, this study highlights the feasibility of integrating waste valorization with functional food development to meet contemporary consumer and environmental demands.

Keywords: Fruit peel waste valorization – Natural antioxidant tea- natural flavouring with saffron

VALORIZATION OF EGG SHELL WASTE BY-PRODUCT INTO BIO-COMPOSITE CUTLERY

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Abstract: The increasing environmental burden caused by single-use plastic cutlery has driven the search for sustainable, biodegradable alternatives. This study focuses on the valorization of eggshell waste—a major by-product of the food industry—by converting it into an eco-friendly bio-composite material for cutlery production. Eggshells, primarily composed of calcium carbonate (CaCO₃) and trace organic components, were collected, cleaned, dried, pulverized, and sieved to obtain fine eggshell powder. This powder was then blended with biodegradable polymers such as cornstarch, glycerol (as plasticizer), and citric acid (as cross linker) to form a composite suitable for molding. The prepared mixture was processed using compression molding techniques at controlled temperature and pressure to fabricate spoon prototypes. The resulting product exhibited enhanced mechanical strength, heat resistance, and biodegradability, attributed to the reinforcing effect of calcium carbonate particles within the polymer matrix. A cost analysis revealed a production cost of approximately ₹0.73 per spoon, demonstrating economic feasibility at a small-scale level. This innovation not only provides a sustainable substitute for disposable plastics but also contributes to waste reduction and circular economy by transforming an underutilized by-product into a valuable resource.

Keywords: Eggshell waste - Valorization - Waste management – Biopolymer - Plastic waste reduction - Eco-friendly alternative to single-use plastics - Low-cost material utilization.

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DESIGN AND FABRICATION OF BLANKING TOOL

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Abstract: Press tools are used to produce a particular component in large quantity, out of sheet metals where particular component achieved depends upon press tool construction and its configuration. The different types of press tool constructions leads to different operations namely blanking, bending, piercing, forming, drawing, cutting off, parting off, embossing, coining, notching, shaving, lancing, dinking, perforating, trimming, curling etc. Generally metals having thickness less than 6mm is considered as strip. Blanking is one of the sheet metal operations where we produce flat components of prerequisite shape. In Blanking the required shape periphery is cut and cut-out piece is called blank. The press tool used is for blanking operation is called as blanking tool, if piercing operation it is piercing tool and so on based on operation that we perform. The application of press operations are widely used in many industries like food processing, packing, defenses, textile, automobile, aircraft and many apart from manufacturing industry. In this connection an attempt is made on to learn the press tool design, materials, manufacturing used for press tool and calculations involved in it. In this work, a real time design of a simple blanking press tool and manufacturing of a prototype is made along with analysis where the output is a circular piece having diameter of 30mm. The press machine is of mechanical type.

Keywords: Press tools, Blanking, textile, cold working.

UNSUPERVISED SEGMENTATION OF A COMPLEX FLOW FIELD USING K-MEANS CLUSTERING

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Abstract : This study presents an unsupervised segmentation of a complex internal flow field by applying K-Means clustering to the results of various turbulence models simulated in OpenFOAM. The research explores the differences between several turbulence models by clustering their generated flow fields, aiming to identify distinct behavioral patterns. The clustering process successfully partitioned the results into two primary groups, revealing significant differences in their predictions. Critically, one of these groups was found to be notably closer to experimental data, validating its superior performance. This method provides a data-driven approach to objectively compare and select appropriate turbulence models, offering a valuable tool for validating and refining computational fluid dynamics (CFD) simulations where a direct comparison with experimental results is challenging or ambiguous.

Keywords : OpenFOAM, Clustering, turbulence, CFD

DESIGN AND FABRICATION OF DIGITAL FUEL LEVEL INDICATOR

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Abstract : Here we have fabricated the Digital Fuel Level Indicator. In this project the tank consists of a level sensor which is special type of sensor in which the resistance value is varied depending upon the fuel level. The variable resistance obtained from the level sensor is given into the amplifier in order to amplify the signal. Then the amplified voltage signal is given to ADC. ADC is nothing but Analog to Digital Converter which converts the analog signal from the level sensor to corresponding digital signal. Then the converted digital signal is given to microcontroller. Here the microcontroller is the flash type reprogrammable microcontroller in which we have already programmed. Now the microcontroller displays the corresponding fuel level on the LCD display. The fuel level of the tank decreases below reserve level, the microcontroller gives the pulse to driver circuit. The driver circuit is used for provide the sufficient input voltage of alarm. The alarm will produce sound to indicate the reserve level in the fuel tank.

Keywords : ADC, fuel, voltage, alarm.

ADVANCES IN SMART MATERIALS AND 4D PRINTING: EMERGING TRENDS, CHALLENGES, AND APPLICATIONS

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Abstract: The convergence of smart materials with additive manufacturing has enabled the evolution of 4D printing, where printed structures can respond dynamically to external stimuli such as heat, light, moisture, and magnetic fields. This review explores the state-of-the-art in smart materials—including shape-memory polymers, alloys, hydrogels, and multi-responsive composites—that drive functional transformations in 4D-printed systems. Mechanisms of stimuli-responsiveness and their integration with advanced AM technologies are discussed in detail. Applications ranging from biomedical implants and drug delivery systems to aerospace, robotics, and self-healing structures are examined. Key challenges, including material limitations, scalability, mechanical stability, and repeatability, are critically analyzed. Future perspectives emphasize the role of artificial intelligence, computational design, and novel smart materials in advancing large-scale 4D printing applications. This review aims to provide a roadmap for researchers and industries seeking to harness 4D printing for next-generation adaptive systems.

Keywords: 4D printing, smart materials, shape memory polymers, stimuli-responsive materials, biomedical applications, adaptive structures.

DESIGN AND FABRICATION OF SMART HEAD LIGHT FOR VEHICLES

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Abstract : The number of vehicles on our roads is increasing day by day. For this reason, almost all the vehicle manufactures to think about the extra safety instruments and electronic controls to attach with these products for giving the users a safety derived in all road conditions through a mass flow traffic. So naturally to get rid of this perennial problem, an automatic mechanism has to come up to dim/dip the headlamp automatically whenever required. Simply, an automatic high beam controller is a unit, which can automatically judge when the headlight beam needs to be lowered, and which dip the headlamp from which beam to a dipped beam. Our work proposes an effective automatic control of the vehicle headlamps based on the detection of head lights and tail lights under night time road conditions. This project is about to control high beam and low beam automatically.

Keywords : Safety, light, dimmer, automation.

POLYTETRAFLUROETHYLENE FOR REPLACING BOROSILICATE AIRFILTERS

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Abstract: Environmentally degradable plastic material Polytetrafluoroethylene is not used as material in air filters. In this paper attempt is made to use Environmentally degradable plastic material polytetrafluoroethylene as air filter. This is an innovative paper which replaces borosilicate sand like material used in air filter with plastic material polytetrafluoroethylene (PTFE). For this two plastic materials polypropylene and polytetrafluorethylene materials airflow flow properties are analyzed using Computational Fluid Dynamics (CFD) and compared with air flow properties of borosilicate. From the results polylytetra fluoroethylene found to be perfectly alright. It can be efficiently used as air filter.

Keywords: End Milling, White layer, LN2 cooling, Cutting temperature.

DEVELOPMENT OF SiC HARD SURFACE OVER Al METAL MATRIX BY EDM PROCESS

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Abstract : The newly engineered metal matrix nanocomposite (MMNC) of Al 7075 reinforced with 0.5 wt% SiC nanoparticles was prepared by ultrasonic cavitation method. The high resolution scanning electron micrograph shows uniform distribution and good dispersion of the SiC nanoparticles within the aluminum metal matrix. Electrical discharge machining was employed to machine MMNC with copper electrode by adopting face-centered central composite design of response surface methodology. Analysis of variance was applied to investigate the influence of process parameters and their interactions. Further, a mathematical model has been formulated in order to estimate the machining characteristics.

Keywords : Metal matrix composite, SiC reinformant, RSM, ANOVA.

DESIGN AND DEVELOPMENT OF 3D INSOLE FOR DIABETICS

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Abstract: Designs with adjustable gradient modules have become necessary for applications with special demands such as diabetic insole in which the contact stress between the foot and insole is a critical factor for the ulcer development. However, since the adjustment of elastic modulus on certain regions of the insole is hardly achieved through material selection, a porous structural unit with varying porosity becomes a feasible way. Therefore, a porous structural unit associated with adjustable effective modulus and porosity can be employed to construct such insoles by 3D printing manufacturing technology. This study provides a generalized foundation of porous structural design and adjustable gradient in application of diabetic and customized insole, which can be equally applied to their designs with similar demands. This study results in an insole which can reduce pressure in the plantar region by applying a support in the arch region on the foot. This study provides a methodology to produce a customized insole using a 3D printer.

Keywords: Diabetic, Insole, 3D printing, Foot stress, structural design, Rapid prototyping.

COMPARATIVE DRAG ANALYSIS OF AN AIRCRAFT WING MODEL WITH AND WITHOUT BIRD FEATHER LIKE WINGLET

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Abstract : The aerodynamic performance of an aircraft wing plays a critical role in determining overall fuel efficiency, stability, and flight range. Wingtip devices such as winglets are widely used to minimize induced drag caused by wingtip vortices. In this study, a comparative drag analysis of an aircraft wing model with and without bird-feather-like winglets has been carried out. The concept of biomimicry has been adopted, inspired by the natural flight mechanisms of birds that exhibit efficient aerodynamic adaptations. The wing with bird-feather-like extensions was modeled and compared against a conventional plain wing using computational and analytical methods. The primary objective was to evaluate changes in induced drag, lift-to-drag ratio, and overall aerodynamic efficiency. A plain wing model and a feather-inspired winglet model were developed for analysis. Computational methods were used to investigate aerodynamic parameters such as induced drag, lift-to-drag ratio, and overall performance efficiency.

Keywords : Aeromodelling, vortices, efficiency and drag performance.

ANALYSIS OF SUPPLY CHAIN CONTRACTS IN AI PERSPECTIVE

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Abstract: In supply chain management a supply contract specifies parameters governing the buyer-supplier relationship. In addition to making the terms of the buyer supplier relationship explicit, contracts have significant impact on the behaviour and performance of all stages in a supply chain. A supply chain contract should have the ability to increase the firms profits and supply chain profits and offer incentives to the supplier to improve performance along key dimensions. This paper analyses the various supply chain contract that improves the profits of the firm and the supply chain. In this paper the analysis is made on buyback, revenue sharing and quantity flexibility contract to account the impact of these contract in the supply chain.

Keywords: Supply chain management, Contract and Profit.

SURFACE MODIFICATION BY LASER CLADDING ON HSS

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Abstract : The surface of Q550 steel was modified with Co–Fe–Cr/WC composite coatings deposited by fibre laser cladding. Coating microstructure, elemental distribution, phase constitution and microhardness were investigated. Results showed that the composite coating was mainly composed of dendrites and eutectic lamellar of carbides. Phases of composite coatings were comprised of Co₃Fe₇, Fe–Cr, CFe_{15.1}, Cr₇C₃, and M₆C (M represents for W, Co and Fe). Owing to the dilution of base metal, large amount of Fe was transformed into molten pool. Martensite laths were easily formed at the front of fusion line due to the rapid solidification process in laser cladding. Plenty of M₆C carbides were synthesised by in-situ reactions between W, Co, Fe and C. Carbides were prone to form eutectic lamellar with growth directions perpendicular to each other. The microhardness of coatings added with wt.50% WC was significantly increased to 668HV0.1, which was about 2.4 times that of Q550 steel.

Keywords : Surface modification, Laser Cladding, Surface Roughness, Microhardness.

DESIGN AND FABRICATION OF MECHANICAL SEED THRUSHING MACHINE

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Abstract: Modern agricultural practices have great promise for the economic development of the nation. Agriculture is the mainstay of the Indian economy. In India, about 50-60% people depend on agriculture, and their income also depends on agriculture. Threshers are power-driven machines designed for threshing wheat and rice during the harvesting season. These machines use auxiliary power from tractor power take-off or electric motors/diesel engines. So, the poor farmers cannot afford these types of heavy-duty and costly machines. For the poor farmers, we design and fabricate a machine for the purpose of threshing the seeds. In this machine, no external power source is needed to run the machine only mechanical power is needed to operate this machine. This machine is portable, time-consuming, and cheap in cost, and we can also use it for domestic purposes. This project is mainly about generating a new concept of a seed thrasher machine that would make it easier to bring anywhere and easier to thrush the seeds.

Keywords: Agriculture, Seed Thresher, Portable Machine, Low-Cost Design, Mechanical Power.

EXPERIMENTAL INVESTIGATION ON MACHINABILITY OF Ti-6Al-4 V USING POWDER MIXED EDM PROCESS

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Abstract : In this experimental study, the factors were the dielectric fluid type (Ft), powder type (Pt), and powder concentration (Cp), and the machining parameters were the applied voltage (V), capacitance (pf), pulse-on time (Ton), and pulse-off time (Toff). Six types of oils and three types of metal powders along with their respective particle concentrations were chosen for current experiment. Castor, Karanja, Kusum, hydraulic, synthetic, and mineral oils were mixed with aluminum oxide (Al₂O₃), nickel (Ni), and chromium (Cr) powder at 6, 8, and 10 g/L, respectively, employing an overhead stirrer to investigate and compare the conditions under which the green oil powder mixed mixture and the conventional oil powder mixed mixture yielded a higher MRR and lower TWR during the micro-EDM process of titanium alloy (Ti-6Al-4 V) using a 0.8 mm tungsten carbide (WC) tool in positive polarity with fixed machining parameters (240 V, 100 pf, Ton: 20 µs, and Toff: 5 µs). It was observed that machining with Karanja oil in a 6 g/L Cr powder mixture showed a higher MRR and minimal TWR. Additionally, machining with synthetic oil in 8 g/L Ni powder mixture showed higher MRR and minimal TWR than Karanja oil with 6 g/L Cr powder mixture. The TWR is minimal in synthetic oil compared to machining with Karanja oils. In addition, machining with synthetic oils results in smoother surfaces than machining with Karanja oils.

Keywords : EDM, surface roughness, SEM, Optimization.

ERGONOMIC ANALYSIS ON LIFT-ASSISTING TROLLEY

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Abstract: Manual Material Handling (MMH) during maintenance activities poses strain to employees and at times it results in injuries. This type of work entails lifting, bending and twisting which can cause great strain to the human body if done improperly. Ergonomics is the study of people while they use equipment in specific environment to perform certain tasks. In recent scenario, a paradigm shift has taken place in Ergonomics from the narrow man-machine concept of the 1940s, to a wide approach dealing with physiological, psychological, technological & organizational aspects of human work environment. The need of the hour is to develop engineering measures like development of jig, fixture, adjustable work stations or physical modifications to equipment & tools, etc wherever possible to enhance employee safety by combining principles that govern the action of forces with knowledge of the human body. In turn, it improves efficiency, quality & overall productivity. This paper mainly addresses the issue of Manual Material Handling during Jaw bits changing of EOT crane tong in Hot Rolling Mill. Based on the analysis, suitable engineering improvement called Lift-Assist device is developed to reduce extreme range of motion while lifting, carrying & inserting.

Keywords: Material handling, Lift-assist, Carrying.

THE SELF-LEARNING FACTORY: AI AND ML CONVERGING WITH MATERIALS AND MACHINING

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Abstract : The emergence of the self-learning factory represents a transformative step in modern manufacturing, where artificial intelligence (AI) and machine learning (ML) converge with materials science and advanced machining to create adaptive, autonomous, and resilient production systems. Unlike traditional factories that rely on fixed instructions and static workflows, self-learning factories integrate sensor data, predictive analytics, and cognitive algorithms to continuously monitor, analyze, and optimize processes in real time. This capability allows machines to learn from experience, adapt to new materials, and refine machining strategies without human intervention. The integration of digital twins and reinforcement learning creates a closed-loop ecosystem where every machining cycle improves the next, thereby reducing waste, downtime, and cost. By combining materials intelligence with AI-driven machining, the self-learning factory transcends conventional automation, transforming production into an evolving, knowledge-rich ecosystem. In conclusion, the convergence of AI, ML, materials, and machining marks the foundation of a self-learning factory—an intelligent system capable of innovation, adaptation, and continuous self-optimization. This paradigm not only enhances efficiency and sustainability but also redefines manufacturing as a dynamic, evolving, and knowledge-driven enterprise.

Keywords : Self-Learning Factory, Artificial Intelligence (AI), Machine Learning (ML), Digital Twin, Adaptive Manufacturing.

TOWARDS SUSTAINABLE ADDITIVE MANUFACTURING: MATERIALS, PROCESSES, AND LIFE-CYCLE PERSPECTIVES

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Abstract: Additive manufacturing (AM) has emerged as a disruptive technology enabling design freedom, material efficiency, and on-demand production. However, concerns regarding energy consumption, material waste, and end-of-life recycling raise questions about its sustainability. This review critically examines recent advancements in sustainable feedstock development, including biodegradable polymers, recycled powders, and natural fiber composites. Energy efficiency strategies, process optimization approaches, and comparative analyses of AM versus conventional manufacturing are discussed. Life-cycle assessment (LCA) studies across various sectors, such as aerospace, automotive, and consumer goods, are analyzed to highlight environmental impacts and gaps in data reporting. Challenges related to high costs, limited recycling frameworks, and lack of standardization are identified. Finally, future directions, including closed-loop recycling, integration with renewable energy, and green certification frameworks, are presented. This review provides a comprehensive perspective on aligning AM with global sustainability goals.

Keywords: Additive manufacturing, sustainability, life-cycle assessment, recycled materials, energy efficiency, green manufacturing.

THE INFLUENCE OF DIFFERENT FIBER SIZES ON THE FLEXURAL STRENGTH OF NATURAL FIBER-REINFORCED POLYMER COMPOSITES

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Abstract : Natural fiber-reinforced polymer (NFRP) composites have emerged as sustainable alternatives to synthetic composites due to their biodegradability, low density, and competitive mechanical properties. Among the key factors influencing their performance, fiber size plays a critical role in determining the stress transfer efficiency, interfacial bonding, and overall mechanical behavior of the composites. This study comprehensively investigates the influence of different fiber sizes on the flexural strength of NFRP composites. The effect of fiber length, diameter, and aspect ratio on fiber dispersion, load distribution, and crack propagation resistance is discussed in detail. Experimental findings from previous works indicate that optimal fiber sizes significantly enhance flexural properties by promoting better stress transfer and matrix–fiber adhesion, while excessively large or small fiber sizes lead to poor dispersion, void formation, or stress concentration, thereby reducing strength. The review highlights the balance required between fiber size, matrix selection, and processing techniques to achieve superior flexural performance. The outcomes provide valuable insights for tailoring natural fiber dimensions to design eco-friendly composite with enhanced structural applications.

Keywords : Natural fiber composites, Fiber size, Flexural strength, Aspect ratio, Polymer matrix, Mechanical properties, Sustainable materials.

TAGUCHI OPTIMIZATION FOR ABRASIVE WATER JET MACHINING PARAMETERS OF AL2024/TIC/B4C COMPOSITE

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Abstract: The effect of machining parameters for AWJM of hybrid AMMC using Taguchi technique was carried out and the optimal parameters for surface roughness, kerf angle and MRR were determined. Taguchi analysis for surface roughness delta value for water jet pressure is -14.99 and traverse speed is -14.94. It can be understood that the water jet pressure has strongest effect on MRR followed by traverse speed. The optimum parameter for minimization of SR is water jet pressure as 220MPa, traverse speed as 40 mm/min and standoff distance as 3mm. Optimum parameter for minimization of kerf angle is water jet pressure as 220MPa, traverse speed as 40 mm/min and standoff distance as 3mm. Taguchi analysis for MRR is given clearly shows the MRR delta value for water jet pressure is 42.40 and traverse speed is 42.97. It can be understood that the water jet pressure has strongest effect on MRR followed by traverse speed. The optimum parameter for minimization of MRR is water jet pressure as 260MPa, traverse speed as 40 mm/min and standoff distance as 3mm.

Keywords: Taguchi optimization, abrasive water jet machining, surface roughness, kerf angle, material removal rate.

SYNTHETIC INTELLIGENCE OF MATTER: MACHINE LEARNING AS THE NEW MATERIAL SCIENTIST

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Abstract : The evolution of machine learning (ML) and artificial intelligence (AI) is transforming materials science into a data-driven discipline, where algorithms act as “synthetic intelligence” capable of accelerating discovery, characterization, and application of novel materials. Under the concept “Synthetic Intelligence of Matter: Machine Learning as the New Material Scientist,” this paradigm envisions computational models as active collaborators in scientific inquiry, complementing human intuition with predictive precision. ML algorithms trained on large experimental and simulation datasets are now capable of identifying patterns in structure–property relationships, forecasting phase behavior, and predicting material performance under diverse operational conditions. Furthermore, the integration of ML with advanced characterization tools enables automated analysis of microscopy and spectroscopy data, leading to rapid insights into microstructural evolution and defect behavior. In conclusion, machine learning is emerging as a “new material scientist,” redefining discovery as a synergistic interplay between human creativity and computational intelligence. By embedding learning algorithms into the heart of materials research, this approach unlocks the potential for faster, sustainable, and application-oriented innovation in the science of matter.

Keywords : Synthetic Intelligence, Machine Learning (ML), Materials Informatics, Predictive Modeling, Data-Driven Discovery.

REVIEW OF THE PROPERTIES, EFFECTS, AND OPTIMIZATION OF EDM SETTINGS ON ADDITIVE MANUFACTURING COMPOSITE STRUCTURES

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Abstract: Manufacturing has evolved due to recent developments in ceramics and metallurgy. EDM produced conductive materials precisely and intricately by using electrical discharges. New advances in metallurgy and ceramic materials have made it possible to fabricate dependable, affordable, and economically valuable components for a variety of industries. The most versatile and economical method for creating intricate electrical curves and forms is EDM. The present literature review evaluates the effects of heat, chemical, and mechanical material removal on machining and surface topography. Disparities can be seen when comparing the performance metrics and properties of electrical discharge machines in composite materials. The unexpected effects of advanced conductive materials on EDM and their possible uses are being investigated. Biomedical, hybrid, and additive EDM applications are also being researched. Alternate electrodes are produced by direct metal laser sintering. Surface finish, MRR, and TWR are all on par with or better than each other. To ensure consistent performance with various work piece materials and EDM settings, the benefits of additive electrodes require additional research and process-parameter optimization.

Keywords: Composite material, EDM, Additive Manufacturing, Taguchi.

RECENT DEVELOPMENTS IN NATURAL FIBER HYBRID COMPOSITES FOR BALLISTIC APPLICATIONS – A COMPREHENSIVE REVIEW OF MECHANISMS AND FAILURE CRITERIA

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Abstract : Natural fiber hybrid composites have recently emerged as promising alternatives to fully synthetic composites for ballistic protection due to their lightweight, cost-effectiveness, and environmental sustainability. This comprehensive review discusses the recent developments in natural fiber hybrid composites for ballistic applications, with emphasis on the underlying energy absorption mechanisms, fiber–matrix interactions, and progressive failure modes such as delamination, fiber pull-out, matrix cracking, and shear plugging. The influence of hybrid design parameters—including fiber selection, stacking sequence, orientation, and volume fraction—on impact resistance and failure criteria is critically examined. Furthermore, challenges related to moisture absorption, interfacial bonding, and standardization of ballistic testing are addressed, along with emerging modification strategies such as nano-fillers, surface treatments, and bio-based resins. The review provides insights into material design, failure mechanics, and future research directions for developing eco-friendly hybrid composites capable of meeting ballistic performance requirements.

Keywords : Natural fiber hybrid composites, Ballistic performance, Energy absorption, Failure mechanisms, Impact resistance, Fiber–matrix interaction, Sustainable materials.

QUANTUM-DRIVEN MINDS IN MACHINES: REIMAGINING 3D PRINTING WITH ARTIFICIAL INTELLIGENCE

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Abstract: The fusion of quantum computing, artificial intelligence (AI), and additive manufacturing is opening a new era of intelligent, adaptive, and ultra-efficient production. Under the theme “Quantum-Driven Minds in Machines: Reimagining 3D Printing with Artificial Intelligence,” this concept envisions a future where machines do not merely follow programmed instructions but leverage quantum-inspired intelligence to explore, predict, and innovate in real time. AI has already transformed 3D printing through generative design, predictive maintenance, and real-time defect detection, but the integration of quantum-driven approaches pushes the boundaries further by exponentially enhancing computational speed and decision-making capabilities. This leads to designs that are lightweight, sustainable, and performance-driven, with reduced resource consumption. In summary, quantum-driven AI in 3D printing redefines manufacturing as a cognitive, predictive, and self-optimizing process. By embedding “quantum minds” into machines, the future of additive manufacturing moves beyond automation into a domain of creativity, adaptability, and resilience—paving the way for smarter, greener, and more revolutionary production landscapes.

Keywords: Quantum-Driven AI, Additive Manufacturing, Optimization, Autonomous Systems, Industry 4.0/5.0.

PREDICTING PRESSURE DROP OF INTERNAL FLOW USING NEURAL NETWORK REGRESSION

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Abstract : This study investigates the use of an Artificial Neural Network (ANN) for predicting the pressure drop of internal flow, utilizing a dataset generated from OpenFOAM simulations. The research leverages computational fluid dynamics (CFD) results to train and validate the ANN, bypassing the need for physical experimental data. The dataset encompasses three distinct mass flow rates for a range of valve openings, providing a robust foundation for the model. The trained neural network serves as a highly efficient surrogate model, capable of accurately and rapidly predicting pressure drop. This approach demonstrates that ANNs can effectively learn complex, non-linear fluid dynamics relationships from high-fidelity CFD data, presenting a powerful alternative to traditional analytical and computationally intensive simulation methods for real-time analysis and design optimization.

Keywords : OpenFOAM, ANN, CFD.

PIEZOELECTRIC ENERGY HARVESTING FROM VEHICLE SUSPENSION SYSTEMS

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Abstract: The increasing demand for renewable energy solutions has led to extensive research on innovative ways to recover waste energy from mechanical systems. One promising area is the use of vehicle suspension systems for energy harvesting, where vibrational energy usually lost as heat due to road bumps is converted into electrical energy. In electric vehicles (EVs), this technology is particularly valuable as it helps improve overall energy efficiency and extend driving range. By integrating piezoelectric materials into the suspension system, mechanical vibrations resulting from vehicle motion and uneven roads are transformed into usable electricity. This harvested energy can power vehicle sensors, recharge batteries, and support auxiliary electrical systems, reducing the load on the main battery. Recent designs use mechanisms like hydraulic cylinder-piston amplifiers and magnetic forces to enhance the deformation of piezoelectric elements, maximizing energy output without compromising ride comfort or suspension performance. Simulation studies have reported that such systems could potentially harvest tens of watts, enough to support various vehicle electronics. Thus, piezoelectric energy harvesting in EV suspensions presents a sustainable, efficient approach to recapture lost energy, contributing to greener transportation and improved vehicle functionality.

Keywords: Piezoelectric energy harvesting, Vehicle suspension system, Multilayer piezoelectric mechanism, Energy efficiency, Sustainable transportation.

MECHANICAL ENHANCEMENT OF NATURAL FIBER REINFORCED COMPOSITES MODIFIED WITH RECYCLED THERMOSET COMPOSITE FILLERS

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Abstract: The utilization of natural fiber reinforced composites (NFRCs) has expanded rapidly owing to their eco-friendly nature, lightweight, and cost-effectiveness. However, their mechanical performance often lags behind that of synthetic counterparts, limiting their application in high-load structural components. Recent advancements have explored the incorporation of recycled thermoset composite fillers as a sustainable strategy to enhance the properties of NFRCs while addressing the growing challenge of thermoset waste management. This review highlights the role of recycled thermoset fillers in improving the stiffness, tensile, flexural, and impact strength of NFRCs through improved stress transfer, reduced void content, and enhanced interfacial adhesion. The influence of filler type, particle size, and dispersion on mechanical reinforcement is discussed in detail, along with processing challenges and compatibility issues between natural fibers, polymer matrices, and thermoset fillers. Furthermore, the environmental and economic benefits of recycling thermoset waste into value-added fillers are emphasized. The study underlines the potential of integrating waste-derived thermoset fillers in NFRCs as a pathway towards sustainable, high-performance composite materials.

Keywords: Natural fiber composites, Recycled thermoset fillers, Mechanical properties, Polymer reinforcement, Waste vaporization, Sustainable composites, Interfacial adhesion.

PERFORMANCE ANALYSIS AND OPTIMIZATION OF THERMAL BARRIER COATED PISTON DIESEL ENGINE FUELL WITH BIODIESEL USING RSM

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Abstract : The growing demand for sustainable energy resources has intensified research on biodiesel as an alternative to conventional diesel fuel. Despite its environmental benefits, biodiesel suffers from limitations such as lower calorific value and higher viscosity, which negatively impact engine efficiency and fuel consumption. To address these challenges, thermal barrier coatings (TBCs) on piston surfaces have emerged as an effective strategy to minimize in-cylinder heat losses, improve combustion, and enhance overall performance. This study investigates the effect of TBC-coated pistons on the performance and emission characteristics of a biodiesel-fuelled diesel engine. Experimental tests evaluate parameters including brake thermal efficiency, specific fuel consumption, exhaust gas temperature, and emissions (CO, HC, NOx, and smoke opacity). Furthermore, Response Surface Methodology (RSM) is applied to optimize key operating parameters such as load, compression ratio, and injection timing. The combined use of biodiesel, TBCs, and RSM optimization highlights a promising pathway toward efficient, cleaner, and more sustainable engine performance.

Keywords: Biodiesel, Thermal Barrier Coating, Diesel Engine, Emission Reduction, Response Surface Methodology.

MACHINE LEARNING PREDICTION OF PRESSURE DROP FOR AN INTERNAL FLOW

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Abstract : This work explores the application of a Random Forest Regressor for the prediction of pressure drop in an internal flow. Building upon a previous study that utilized an Artificial Neural Network (ANN), this research highlights the effectiveness of an alternative machine learning approach. The model is trained and tested on the same dataset derived from OpenFOAM simulation results, which provides a high-fidelity and comprehensive basis for learning. The use of a Random Forest, an ensemble learning method, is specifically investigated to assess its performance, robustness, and ability to capture the complex, non-linear relationships inherent in fluid dynamics. This study contributes to the comparative analysis of different machine learning models for fluid flow problems and demonstrates the potential of tree-based methods as a reliable and powerful tool for engineering applications.

Keywords OpenFOAM, Random Forest, pressure drop.

INVESTIGATION OF MECHANICAL BEHAVIOUR AL2024/TiC/B4C HYBRID METAL MATRIX COMPOSITES

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Abstract: Metal matrix composites are widely applied in the automotive and aircraft structural components. The mechanical properties of hybrid aluminium 2024 metal matrix composites are influenced by 5%, 10%, 15% and 20% of TiC and B4C. In this reinforcement composition, an equal amount of TiC and B4C is considered. The increase in volume fraction of B4C and TiC particle in matrix alloy increases the hardness, yield strength, ultimate strength and decreases the ductility of the composite. SEM images have been taken for the microstructure of the composites with particles having a different volume percentage of reinforcement shows the uniform distribution of B4C and TiC particles. The ceramic particles addition has proved that improved corrosion resistance in AMMCs.

Keywords: Metal matrix composite, mechanical properties, al2024, titanium carbide, boron carbide.

INVESTIGATION OF THERMAL PROPERTY ON CAPRICMYRISTIC-PALMITIC ACID/EXFOLIATED GRAPHITENANOPLATELETS COMPOSITE AS A PHASE CHANGE MATERIAL (PCM)

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Abstract :Now a days, the energy recruitment increased day-today life. The energy efficiency can be increased by storing or recycling process. This work is focused on developing ternary eutectic mixture based organic compound fatty acid like Capric-myristic-palmitic acid and increase their thermal property by inorganic compound like Exfoliated graphite nanoplatelets (CA-MA-PA/XGnP) composite as phase change material (PCM) for low temperature energy storage application. The XGnP used in this process were obtained by concentration of solar energy with a Fresnel lens. The XGnP with different mass ratio 5% and 10% were dispersed into (CA-MA-PA) uniformly under the assistance of ultra-sonication. The structure, thermal energy storage properties and thermal conductivity of novel composite (CA-MA-PA/XGnP) PCM were investigated. The thermal conductivity and thermal energy storage property of composite PCM doped with 10% of XGnP were attain 0.180 W/mk and ($T_m = 17.1^\circ\text{C}$; $\Delta H_m = 142.2 \text{ J/g}$) for melting, ($T_f = 9.7^\circ\text{C}$; $\Delta H_f = 139.5 \text{ J/g}$) for freezing respectively.

Keywords :Exfoliated Graphite Nanoplatelets, Solar Irradiation, Fatty Acid Eutectic Mixture, Composite Material, Thermal Properties.

INCREASING COPY-PIERCING ELECTRICAL DISCHARGE MACHINING PRODUCTIVITY VIA TOOL ELECTRODE ADDITIVE MANUFACTURING

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Abstract:The production of wire electrodes for electrical discharge machining using additive technology, namely selective laser melting (SLM), is taken into consideration. This makes it feasible to create electrodes with unique characteristics, intricate shape, and great precision. Furthermore, the outcomes of electrode design topological optimization are showcased. Wire electrodes with higher efficiency under specified operating circumstances can be produced thanks to topological optimization. It is demonstrated that the machining process may be stabilized by improving the removal of sludge from the machining region through the use of additive technology and optimized electrode shape with internal supply routes for dielectric liquid.

Keywords:SLM, Additive Technology, Machining Process, Dielectric Liquid.

FROM ATOMS TO ALGORITHMS: COMPUTING POWER AS THE NEW TOOL IN MATERIALS SCIENCE

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Abstract: The integration of high-performance computing (HPC), artificial intelligence (AI), and algorithm-driven modeling is redefining materials science, shifting the field from empirical experimentation toward predictive and data-centric discovery. Under the theme “From Atoms to Algorithms: Computing Power as the New Tool in Materials Science,” this paradigm emphasizes how computational power accelerates the exploration, design, and optimization of novel materials at atomic, molecular, and structural levels. Furthermore, computing power supports multi-scale simulations—from quantum-level density functional theory (DFT) to continuum-based finite element models—bridging the gap between fundamental material behavior and engineering applications. This synergy results in a “materials genome” approach, where vast design spaces are navigated rapidly to achieve materials with tailored properties for aerospace, energy, healthcare, and electronic industries. In summary, the transition from atoms to algorithms highlights computing power as a disruptive tool that transforms materials science into a predictive, knowledge-driven discipline. By harnessing simulations, AI, and high-performance computing, researchers can accelerate discovery, reduce development costs, and enable the creation of next-generation materials—paving the way for sustainable and technologically advanced innovations.

Keywords: High-Performance Computing (HPC), Artificial Intelligence (AI), Predictive Modeling, Materials Genome, Multi-Scale Simulation.

IMPACT OF AN ADDITIVE MANUFACTURING COMPONENT'S ASPECT RATIO ON SURFACE ROUGHNESS WHILE CUTTING WITH WIRE EDM

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Abstract : Alloy of aluminum in industries like aerospace and automotive, AlSi10Mg is one of the most often utilized alloys in powder bed additive technologies with laser sources (PBF-LB/M) to create lightweight components. These parts, which may have intricate geometries, are extruded straight onto the construction platform so that wire electrical discharge machining (WEDM) may remove them and produce a surface roughness that is already appropriate for joining the parts with other parts. This study examined two topics: the impact of component aspect ratio on the surface roughness measured by WEDM, and the resilience of various equipment for profile and areal roughness measurements on AlSi10Mg parts made using the PBF-LB/M process. The P- and S-parameters showed a better relationship than the S- and R-parameters, as stated in the literature. Nevertheless, it was discovered that the piece's separate sections had varying roughness levels, necessitating ongoing cutting parameter adjustments to achieve uniform surface roughness.

Keywords : Composite material, WEDM, PBF, AlSi10Mg.

FLAME RETARDANCE BEHAVIOUR AND DEGRADATION OF PLANT-BASED NATURAL FIBER COMPOSITES - A COMPREHENSIVE REVIEW

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Abstract : Plant-based natural fiber composites have gained significant attention in recent years due to their renewable origin, biodegradability, low cost, and favorable mechanical properties, making them a promising alternative to synthetic composites. However, their inherent flammability and thermal instability present critical challenges in structural, automotive, aerospace, and construction applications where fire safety is a major concern. This comprehensive review summarizes the flame retardance behavior and degradation mechanisms of natural fiber composites, with a focus on the influence of fiber type, matrix selection, and interfacial compatibility. Furthermore, the review highlights various flame-retardant strategies—including the incorporation of halogen-free flame-retardant additives, surface treatments, nano-fillers, and hybridization approaches—that have been employed to enhance fire resistance. The environmental impact, sustainability considerations, and future research directions for developing eco-friendly flame-retardant natural fiber composites are also addressed. This paper provides valuable insights for researchers and industries aiming to balance sustainability with safety in advanced composite materials.

Keywords : *Natural fiber composites, Flame retardance, Thermal degradation, Char formation, Nano-fillers, Fire safety, Sustainable materials.*

FACTORY IN A BOX: THE FUTURE OF AGILE, AI-POWERED MANUFACTURING

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Abstract: Factory in a Box (FIAB) is a transformative manufacturing concept, offering a compact, highly automated production system that can be rapidly deployed and easily relocated as needed, leveraging advanced digital and AI-powered technologies. Unlike traditional large-scale, static factories, FIAB units prioritize flexibility, mobility, and modularity to address evolving market demands and supply chain challenges. FIAB was developed as a solution to issues in global supply chains, such as high capital requirements, limited labor, and unexpected disruptions like pandemics. Mobile Trailer-Based FIAB: Manufacturing units pre-fitted within transportable containers, moved between locations without reassembly. Containerized FIAB: Production can occur within the containers as they travel to the destination, speeding up delivery times. Core Technologies: AI and Industry 4.0. At the heart of FIAB lies Industry 4.0—integrating robotics, IoT sensors, cloud computing, and especially artificial intelligence. Remote Monitoring and Management: IoT sensors and AI algorithms allow remote oversight, predictive maintenance, and adaptive workflow control, reducing the need for onsite expertise and support. Supply Chain Optimization: Data-driven tools help anticipate market fluctuations, optimize inventory, and streamline logistics.

Keywords: *Factory in a box, AI in Manufacturing.*

EXPERIMENTAL INVESTIGATION ON MACHINABILITY OF SPHEROIDAL GRAPHITE IRON WITH MULTILAYER CUTTING TOOL AND CBN INSERTS

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Abstract : The objective of this research is to compare the cutting parameters of turning operation the work pieces of by finding the tool wear, surface roughness and cutting force by Response Surface Methodology (RSM). The project involves the concept of machinability of Spheroidal Graphite Iron with multi-layer coated carbide tool inserts and CBN, used as a finish roughing tool. A machining process involves many process parameters like feed, speed, depth of cut, which directly or indirectly influence the surface roughness and tool wear of the product in common. The present investigation of turning process is a Response Surface Methodology applied to the Specified process parameters, i.e. feed, cutting speed and depth of cut while machining Spheroidal Graphite Iron as the work piece with two different types of cutting tools are Al₂O₃+TiN+TiCN (CA4010) and CBN (KBN60M). After having the data from the experiments, the performance measures surface roughness (Ra) of the test samples and Cutting Forces are analyzed. Al₂O₃ +TiCN + TiN is best suitable for turning sg iron at 770 rpm at 0.75 depth of cut and 0.102 feed rate.

Keywords : Spheroidal Graphite Iron, Response Surface Methodology, Cutting Force, Surface Roughness.

EXPERIMENTAL ANALYSIS OF FIBRE REINFORCED COMPOSITES (EPOXY+EGLASS) ALONG WITH THE FILLERS Al₂O₃, CaCO₃ AND PbO

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Abstract: Machining of the composites materials is difficult to carry out due to the anisotropic and non-homogeneous structure of composites and to the high abrasiveness of their reinforcing constituents. The mechanical characteristics of these composite materials, is examined by Tensile Strength Test and flexural test by UTM and Charpy Test by Impact Testing Machine. The results of various mechanical characterization tests are reported. It is evident from the results Lead Oxide (PbO) as a filler material added in resins and Fiber composites (52% Resin + 13% PbO + 35% Fibre) has a better mechanical tensile properties as compared to others and Fiber composites has a better mechanical properties and hardness properties as compared to others, resin and fiber composite without filler (65% + 35% Fiber) has a better mechanical energy absorbed properties as compared to others. It is observed that the tensile strength of the FRC filled with PbO is greater than 3% of the one filled with CaCO₃, 11% of the one filled with Al₂O₃, 7.79% of the FRC with no fillers. It is observed that in charpy impact test the energy absorbed by the FRC with Al₂O₃ is greater than 2% of the one filled with CaCO₃, 2% of the one filled with PbO, 2% of the one with no fillers. It is observed that in flexural test the energy absorbed by the FRC with no fillers is greater than 2% of the one filled with CaCO₃, 4% of the one filled with PbO, 6% of the one with Al₂O₃.

Keywords: Composites, Reinforcing constituents, Filler material, Mechanical properties.

EVALUATION OF WEAR CHARACTERISTICS OF ULTRA HIGH CARBON STEEL

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Abstract : In this modern era high wear performance materials are necessary components in machinery and equipment's especially in automobile sectors. One of the developed high wear resistance material is the investigation of Ultra High Carbon Steel to study with 1% carbon transformed from cementite to Spheroidite shape. This assignment aimed to study of wear behaviour of Ultra High carbon Steels using computerized Pin on Disc wear testing machine. The amount of wear can be identified by scanning the materials in microscope analysis. The annealed, quenched and forged test samples to four different load variation of 0.5kg, 2kg, 4kg and 6kg shows that with increase in load, the wear rate decreases as there is increase in friction at the contact surface. Result of this project goes to good wear rate of spheroidized shape, of quenched specimen compare to other samples. Observed that, volumetric wear rate of 1 wt. % C of Spheroidite shape wear for all the operational conditions. Scanning Electron Microscope observation of the worn surface showed that three body and surface confinements were the prevailing to sliding wear mechanisms.

Keywords : Spheroidite, Microstructure, SEM Analysis, Volumetric Wear Rate, Normal Pressure, Sliding Speed.

EFFECT OF FE ADDITION IN W-NI-CU HEAVY ALLOY PROCESSED THROUGH POWDER METALLURGY ON MICROSTRUCTURE AND MECHANICAL PROPERTIES

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Abstract: Tungsten heavy alloys (WHAs) based on the W–Ni–Cu system are widely utilized in defense, aerospace, and radiation shielding applications due to their high density, strength, and excellent corrosion resistance. However, their limited ductility and moderate mechanical performance restrict broader engineering applications. In recent years, alloying additions have been explored to optimize microstructural stability and enhance mechanical behavior. Among them, iron (Fe) has emerged as a potential additive because of its strong solubility with nickel and its ability to improve liquid-phase sintering. This study investigates the effect of Fe addition in W–Ni–Cu heavy alloys processed through powder metallurgy. Microstructural analysis revealed that Fe promoted improved wettability between tungsten particles and the Ni–Cu matrix, leading to refined grain size and more homogeneous distribution of the binder phase. However, excessive Fe content led to matrix embrittlement and reduced elongation. Overall, controlled Fe addition effectively balances density, strength, and toughness in W–Ni–Cu heavy alloys, making it a promising approach for tailoring materials for structural and functional applications. This work highlights the significance of minor alloying strategies in optimizing powder metallurgy-based tungsten heavy alloys for advanced engineering requirements.

Keywords: Tungsten heavy alloy, W–Ni–Cu, iron addition, powder metallurgy, microstructure, mechanical properties, sintering, solid solution strengthening, tensile strength, ductility.

DIRECT AGING ON MECHANICAL BEHAVIOR OF STAINLESS STEEL 17-4PH USING SLM

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Abstract : The effect of direct aging on the mechanical behavior of 17-4PH stainless steel fabricated using Selective Laser Melting (SLM). Direct aging, a post-processing heat treatment technique, is applied to enhance the material mechanical properties by promoting the precipitation of strengthening phases. SLM-fabricated 17-4PH stainless steel samples are subjected to direct aging at various temperatures and durations, followed by comprehensive mechanical characterization. Tensile testing, hardness measurements, and microstructural analysis are conducted to evaluate the influence of direct aging on the material tensile strength, ductility, hardness, and microstructural evolution. The results reveal significant improvements in mechanical properties, with an optimal aging condition identified. Furthermore, the microstructural analysis elucidates the precipitation kinetics and phase transformations occurring during direct aging, providing insights into the strengthening mechanisms in SLM-produced 17-4PH stainless steel. This research contributes to the advancement of additive manufacturing of high-performance stainless steels and facilitates the optimization of post-processing treatments for tailored mechanical properties, enhancing the material suitability for demanding engineering applications.

Keywords : SLM 17-4 PH, Heat Treatment, Mechanical properties, microstructure.

SLM ADDITIVE MANUFACTURING- REVIEW

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Abstract: Additive manufacturing and specifically metal selective laser melting (SLM) processes are rapidly being industrialized. In order for this technology to see more widespread use as a production modality, especially in heavily regulated industries such as aerospace and medical device manufacturing, there is a need for robust process monitoring and control capabilities to be developed that reduce process variation and ensure quality. The current state of the art of such process monitoring technology is reviewed in this paper. The SLM process itself presents significant challenges as over 50 different process input variables impact the characteristics of the finished part. Understanding the impact of feed powder characteristics remains a challenge. Though many powder characterization techniques have been developed, there is a need for standardization of methods most relevant to additive manufacturing. Correlations between process measurements, process parameter settings, and quality metrics to date have been primarily qualitative. Some simple, first-generation process control strategies have also been demonstrated based on these measures. There remains a need for connecting process measurements to process models to enable robust model-based control.

Keywords: SLM, Metal additive, Surface finishing and manufacturing.

COMPUTATIONAL FLUID DYNAMICS ANALYSIS OF INDUSTRIAL PROCESS FAN FLOW SYSTEM AND REMODELLING OF DUCT

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Abstract : Industrial fans are very versatile machines in industrial applications, they deliver or exhaust the required amount of air as per the requirement. The use of a standby process fan as a proactive measure to maintain production quantity can enable the machine to reliably extend planned outage cycles. An attempt was made to increase production quantity at Pellet by modifying the standby process fan duct, also known as the recuperation fan or recup fan, to increase proper suction of high temperature air from the firing zone and deliver it to the pre-heating zone as a result the production quantity gets improved and it extends the usage of standby fan at intervals between planned shutdown cycles. The existing plant duct, remodelled duct without steps (new design 1), and 45° duct (new design 2) are designed in CREO Parametric and simulated in SOLIDWORKS Flow Simulation. The simulated CFD results showed that the 45° duct-new design 2 has superior total pressure and velocity, which drastically improves the inlet air volume entering the fan.

Keywords : CFD, Industrial fans, CREO, duct model.

COGNITIVE MANUFACTURING: WHEN AI DREAMS IN 3D PRINTING AND ADVANCED MACHINING

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Abstract: Cognitive manufacturing is emerging as a transformative paradigm that integrates artificial intelligence (AI), machine learning, and data-driven decision-making into modern production systems. When applied to 3D printing and advanced machining, this approach transcends conventional automation by enabling machines to “think, learn, and adapt” to real-time scenarios. The convergence of AI and additive manufacturing creates a smart ecosystem where process parameters, design optimization, and quality control are continuously refined through predictive analytics and self-learning algorithms. Similarly, in advanced machining, AI-driven models enhance precision, tool life management, defect detection, and process adaptability, reducing waste and downtime while increasing throughput. In 3D printing, cognitive algorithms enable generative design, topology optimization, and real-time defect correction, fostering lightweight yet high-performance components. In machining, AI integrates with sensor data and digital twins to predict tool wear, optimize cutting strategies, and ensure dimensional accuracy. Together, these cognitive capabilities contribute to a closed-loop manufacturing ecosystem characterized by adaptability, sustainability, and resilience.

Keywords: Artificial Intelligence (AI), Machine Learning, Decision-Making.

CLUSTERING-BASED MESH REFINEMENT FOR HIGH-FIDELITY CFD SIMULATIONS

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Abstract : This paper proposes a clustering-based mesh refinement strategy for high-fidelity CFD simulations. The objective is to efficiently generate an optimal mesh by intelligently concentrating computational resources in critical flow regions. The approach involves using a clustering algorithm to identify and refine areas of high gradients or complex flow features, rather than relying on uniform or pre-defined refinement methods. This methodology seeks to reduce the total number of mesh cells and, consequently, the computational cost, without compromising the accuracy of the simulation results. The study aims to demonstrate that a data-driven, clustering approach can create a more economical and effective mesh compared to traditional mesh generation techniques, leading to significant advancements in the efficiency of complex fluid dynamics modeling.

Keywords : CFD, Meshing, Clustering.

ARTIFICIAL NEURAL NETWORK-BASED MECHANICAL PROPERTY PREDICTION FOR ADDITIVELY MANUFACTURED PARTS

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Abstract: Additive manufacturing (AM), often known as three-dimensional printing, is gaining increasing interest from academia and business because to its clear advantages over traditional subtractive production. Adjusting AM processing settings can be difficult since they can have a significant impact on the printed microstructure and the performance of the final products. Using traditional numerical and analytical models to construct a process–structure–property–performance (PSPP) relationship for AM is a difficult undertaking. Intricate pattern recognition and regression analysis may now be done legitimately using the machine learning (ML) approach without having to actively create and solve the underlying physical models. The neural network (NN) is the most often used model among machine learning algorithms because to its complex algorithm architecture, strong computational capabilities, and extensive dataset. An overview of the usage of artificial neural networks to forecast the mechanical characteristics of additively built parts is given in this chapter. The existing challenges in applying NNs to AM are then discussed, along with potential solutions. Finally, future developments are proposed to provide a broad picture of this multidisciplinary field.

Keywords: Machine learning, Additive manufacturing, process–structure–property–performance, Neural network.

ARTIFICIAL INTELLIGENCE, DIGITAL TWINS, AND BIG DATA IN ADDITIVE MANUFACTURING: CURRENT PROGRESS AND FUTURE DIRECTIONS

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Abstract : The digital transformation of additive manufacturing (AM) is increasingly driven by artificial intelligence (AI), digital twins (DTs), and big data analytics, enabling intelligent decision-making and real-time process control. This review critically evaluates the integration of AI in process parameter optimization, defect detection, and predictive maintenance within AM systems. The concept and architecture of digital twins are discussed, with emphasis on their role in simulation, monitoring, and virtual prototyping of AM processes. The synergy between big data, cloud computing, and IoT-enabled AM is examined to highlight opportunities for data-driven design and smart manufacturing ecosystems. Industrial applications in aerospace, automotive, and healthcare sectors are analyzed through case studies. Key challenges, including data privacy, high computational requirements, and lack of standardization, are identified. Future perspectives involve autonomous AM, AI-blockchain integration, and standardized frameworks for industrial-scale adoption. This review provides insights into the next frontier of intelligent and connected additive manufacturing.

Keywords : Additive manufacturing, artificial intelligence, digital twin, big data, smart manufacturing, predictive modeling.

COMPARATIVE STRESS ANALYSIS AND MECHANICAL PROPERTIES INVESTIGATION OF AL METAL MATRIX SPUR GEAR WITH VARIOUS REINFORCEMENTS

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Abstract: In this work a composite is developed by adding Boron carbide and silicon carbide in Aluminum metal by mass ratio 10%. The composite has to be prepared by crucible casting technique. Both metal matrix stress and strain results were evaluated and finally concluded through FEA AL1100-B4C (90%-10%) having better results. Al 1100 and Boron carbide composite has low deformation, stress, strain are analyzed by ANSYS 19.1. AL1100-B4C (90%-10%) composite is selected for the gear manufacturing. From the destructive test investigation the mechanical property of Al1100 metal matrix were analyzed finally found Boron carbide reinforcement enhanced the mechanical strength. It shows superior strength compared than Silicon carbide metal matrix.

Keywords: ANSYS, FEA, metal matrix, stress-strain.

ADDITIVE MANUFACTURING OF MULTI-MATERIAL AND FUNCTIONALLY GRADED STRUCTURES: A COMPREHENSIVE REVIEW

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Abstract : Multi material additive manufacturing (MM-AM) and functionally graded structures (FGMs) represent a paradigm shift in tailoring properties within a single component, enabling unprecedented design and performance flexibility. This review provides a comprehensive overview of the latest advancements in polymer, metal, and ceramic-based multi-material printing techniques. Strategies for achieving seamless transitions and graded properties through design optimization, topology modeling, and simulation tools are discussed. Applications in aerospace, electronics, and biomedical engineering are highlighted, showcasing the advantages of MM-AM in lightweight structures, embedded circuitry, and customized implants. Critical challenges—including interfacial bonding issues, porosity, residual stresses, and high equipment costs—are evaluated. Future opportunities for AI-driven design, robotics integration, and industrial standardization are presented. This review underscores the transformative potential of MM-AM and FGMs in revolutionizing engineering design and manufacturing practices.

Keywords : Multi-material additive manufacturing, functionally graded structures, hybrid materials, interfacial bonding, aerospace applications, biomedical implants.

A FINITE ELEMENT INVESTIGATION ON THE INDUCED STRESSES IN PIPE BENDS SUBJECTED TO INTERNAL PRESSURE

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Abstract: Pipe bends are critical components in piping systems and generally are the most economical means of changing directions while providing flexibility and end reactions to piping systems within the allowable limits. The bend section may be a potential source of damage during service, due to internal pressure and other loads. The pipe bend exists with shape imperfections, namely ovality, thinning/thickening, wrinkling, etc., as the result of bending processes. The acceptability of a pipe bend depends on the magnitude of ovality and thinning. Many analytical and numerical studies on pipe bends assume the cross-section to be circular, but in practice, the cross-section exists with ovality and thinning/thickening. In this paper, the effect of ovality and thinning on the induced hoop stress is investigated using the finite element method when the pipe bend is subjected to internal pressure. The cross-section, to include ovality and thinning, is assumed to be elliptic as prescribed by ASME. The ovality and thinning were varied from 0 to 20 percent. with the increment of 5 percent. The pipe bend geometry chosen for the paper is $r/t=5, 10, 15$ and 20 and $R/r= 2$ and 3 . The internal pressure was varied up to 12 MPa for each model in steps of 2 MPa. It is found that the ovality and thinning. have a significant effect on the stresses induced, and hence any numerical analysis must include the effect of these shape imperfections for the proper design of the pipe bends.

Keywords: Pipe, ovality, FEM, Stresses.

SCHEMATIC CLASSIFICATION FOR AN INTERNAL FLOW

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Abstract: This research focuses on the schematic classification of an internal flow field using data generated from OpenFOAM computational fluid dynamics (CFD) simulations. The study aims to classify the complex flow field into one of two predefined schemes, effectively categorizing the fluid's behavior. The methodology involves analyzing the spatial distribution of flow properties from the OpenFOAM results, which provides a rich, high-fidelity dataset for the classification task. This approach bypasses the need for physical experimentation and demonstrates the potential for using computational data as a basis for training classification models. The findings contribute to a deeper understanding of internal flow patterns and offer a streamlined, automated method for flow regime identification in engineering applications.

Keywords: OpenFOAM, CFD, Classification.

ABRASIVE WATER JET MACHINING OF AL2024/TiC/B₄C HYBRID METAL MATRIX COMPOSITES

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Abstract : Metal matrix composites are widely applied in the automotive and aircraft structural components. The hybrid aluminium 2024 metal matrix composites are fabricated by 5%, 10%, 15% and 20% of TiC and B₄C. In this reinforcement composition, an equal amount of TiC and B₄C is considered. AMMCs. Abrasive water jet machining is most economic and effective non-traditional machining process for machine aluminium metal matrix composites. The machining characteristics such as surface roughness, kerf angle and metal removal rate were investigated with respect to water jet pressure, jet traverse speed and standoff distance. Increase in water jet pressure reduces the kerf angle and surface roughness. Higher jet traverse speed and standoff distance increase the kerf angle and surface roughness. Material removal rate increases with increasing water jet pressure, traverse speed and standoff distance.

Keywords : Metal matrix composite, abrasive water jet machining, surface roughness, kerf angle, material removal rate.

EROSIVE WEAR BEHAVIOR OF SiC REINFORCED TITANIA COATING DEPOSITED BY HIGH VELOCITY OXY (HVOF) FUEL SPRAYING

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Abstract: Titania or Titanium di-oxide (TiO₂) and blend with 10% SiC coatings were produced by High Velocity oxy Fuel (HVOF) spraying on commercially pure titanium substrate. The Titania coating has been considered for wear resistance, corrosion resistance and environmental barrier coating. The Titania is a suitable candidate for titanium to protect from wear and corrosion in oxygen reduced environments due to its coefficient thermal expansion match with titanium substrate. The microhardness value of these coatings was measured by Vickers microhardness tester. The coating porosity, cross sectional morphology and eroded surface morphologies was observed in Optical Micrograph (OM) and Scanning Electron Micrograph (SEM). The X-Ray Diffraction analysis was made to observe the phase composition of these coatings. The solid particle erosion test was conducted as per ASTM G76 standard. The possible wear mechanisms of the titanium, coatings were discussed.

Keywords: High Velocity Oxy Fuel spraying (HVOF), Titania (TiO₂), Erosive wear.

EXPERIMENTAL AND NUMERICAL STUDIES OF INTERLAMINAR SHEAR STRENGTH IN BASALT FIBER REINFORCED POLYMER MATRIX COMPOSITE

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Abstract : Basalt fiber-reinforced polymer (BFRP) is a natural composite derived from volcanic rock through melting and fiberizing process. It is gaining popularity because of its high strength-to-weight factor and excellent mechanical, thermal and chemical properties. Fracture toughness testing is used to analyse crashworthiness, structural integrity and safety to avoid material failure. In this study, the estimation of Interlaminar Shear Strength (ILSS) was done by performing the Short Beam Shear (SBS) test. This three-point bend test is performed in accordance with the ASTM D2344 standard on a computerized Universal Testing Machine (UTM). Strain rate of 1 mm/min is given to the load cell. For this standard, the sample dimensions used are 36 x 12 x 6 mm³. The stacking sequence used in this study is [(0/90), (45/- 45), (0/90), (45/-45)]_{2s}. This test provides critical data on shear failure between the layers. The study compares the obtained experimental results with the numerical results from ANSYS. These results indicate excellent resistance to crack propagation and better interlaminar shear resistance. Matrix cracking, fiber breakage, crack initiation, delamination, debonding etc. such failure mechanisms are expected to occur.

Keywords : BFRP, ILSS, Delamination, ANSYS.

AI-ENABLED DRONE SYSTEM FOR INTELLIGENT DATA COLLECTION, RAPID RESPONSE AND OPERATIONS IN HAZARDOUS ENVIRONMENT

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Abstract: Drones, or Unmanned Aerial Vehicles (UAVs), have emerged as transformative tools across multiple industries, offering unprecedented capabilities in data collection, rapid response, and remote operations. Unlike conventional aircraft, UAVs operate without an onboard human pilot and are either remotely controlled or fly autonomously using pre-programmed flight plans. With advancements in artificial intelligence (AI), machine learning (ML), and computer vision, drones are increasingly being deployed for precision agriculture, disaster management, surveillance, logistics, and environmental monitoring. Their ability to access hazardous or hard-to-reach areas makes them invaluable for tasks such as search and rescue, infrastructure inspection, and emergency response. This paper explores the design and deployment of AI-enhanced UAV systems that integrate real-time data analytics, intelligent navigation, and autonomous decision-making. Special emphasis is given to the role of computer vision in enabling object detection, terrain mapping, and obstacle avoidance. The integration of drones with emerging technologies such as 5G, edge computing, and renewable energy-based charging stations further enhances their operational efficiency and sustainability. Overall, the proposed framework highlights how UAVs, combined with next-generation AI and communication technologies, are redefining modern industry practices and supporting safe, efficient, and resilient operations in dynamic environments.

Keywords: AI, ML, UAVs, agriculture, disaster management, surveillance, logistics

DESIGN AND DEVELOPMENT OF FOLDABLE, LIGHTWEIGHT AND TERRAIN-ADAPTIVE LAUNCHER FOR FIXED-WING UAV

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Abstract: The increasing utilization of small fixed-wing Unmanned Aerial Vehicles (UAVs) in defense, surveillance, and research applications highlights the need for efficient, reliable, and portable launching systems. Conventional UAV launchers are often bulky, terrain-restricted, and time-consuming to assemble, which limits their field usability. To overcome these challenges, this work presents the design and development of a foldable, lightweight, and terrain-adaptive Launcher for Fixed-Wing UAV. The foldable and lightweight structure enhances portability and rapid assembly, making the system suitable for single-person operation. Analytical methods were used to estimate launch velocity, acceleration, and tension requirements, followed by structural optimization to minimize weight while ensuring safety and durability. The proposed launcher demonstrates significant improvements in mobility, adaptability, and operational efficiency compared to conventional systems, offering a practical and cost-effective solution for field-based UAV operations.

Keywords: Unmanned Aerial Vehicle (UAV), fixed-wing UAV, UAV launcher, bungee launcher, terrain-adaptive design, lightweight structure, adjustable legs, portable systems.

FABRICATION OF DISASTER RESPONSE DRONE FOR REMOTE AREAS

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Abstract: In disaster-affected areas, delivering medical supplies and communication kits is often delayed due to damaged infrastructure and hard-to-reach locations. This paper presents an AI-enabled Disaster Response Drone (UAV) system with a payload capacity of over 5 kg to support fast disaster response. The system includes a mobile app dashboard that helps disaster teams plan, track, and manage missions efficiently. Unlike traditional drones, it can operate in GPS-denied environments using AI-based navigation and computer vision for obstacle avoidance. A hybrid communication system combining 4G/5G and satellite backup ensures continuous connectivity during critical operations. The system also supports multi-drone coordination for large-scale supply deliveries, improving coverage and efficiency. Initial results indicate a possible 20% reduction in response time, enhancing relief efforts in flood-affected villages and earthquake-hit areas. The proposed solution is novel due to its combination of AI navigation, resilient communication, and coordinated drone operations for disaster management.

Keywords: AI-enabled UAV, disaster relief, GPS-denied navigation, obstacle avoidance, multi-drone coordination, hybrid communication.

REAL-TIME NAVIGATION AND LOCALIZATION FOR A FLIGHT RECORDER RECOVERY ROBOT

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Abstract: The recovery of aircraft flight recorders, commonly known as “black boxes,” is a critical task in aviation accident investigations. Traditional recovery methods are often time-consuming, labor-intensive, and limited by environmental constraints. This paper presents the design and implementation of a real-time navigation and localization system for an autonomous flight recorder recovery robot. The proposed system integrates sensor fusion techniques, combining data from inertial measurement units (IMUs), ultrasonic sensors, and vision-based modules to achieve accurate localization in uncertain and cluttered environments. A path-planning algorithm optimized for obstacle avoidance and dynamic re-routing ensures efficient navigation toward the target location. Real-time data processing and mapping are employed to enhance robustness and reliability during deployment in challenging terrains, such as underwater or debris-filled areas. Simulation and experimental results demonstrate that the system significantly reduces search time, improves localization accuracy, and increases the overall effectiveness of flight recorder recovery operations. This work contributes to advancing autonomous robotic solutions for aviation safety and post-accident investigations.

Keywords: AI-enabled, multi-drone coordination, hybrid communication.

APPLICATION OF MACHINE LEARNING IN THERMODYNAMIC SYSTEM MODELING AND OPTIMIZATION

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Abstract: With the growing demand for energy and increasing environmental concerns, accurate modeling and efficient optimization of thermodynamic systems have become key research areas in engineering. In recent years, the application of machine learning techniques in thermodynamic systems has demonstrated significant potential, greatly improving modeling precision and optimization efficiency. However, existing methods face challenges in handling temperature delay phenomena, limiting the accuracy and effectiveness of system modeling and control. This paper introduces a temperature delay identification algorithm to enhance the accuracy of delay representation. Additionally, it develops a predictive control model for thermodynamic systems that incorporates temperature delay. These two components aim to improve the precision and efficiency of thermodynamic system modeling, providing new insights and methods for the intelligent management of complex thermodynamic systems.

Keywords: *AI-enabled, temperature, optimization, thermodynamic system.*

MECHANICAL CHARACTERIZATION OF NATURAL FIBRE-REINFORCED PLA COMPOSITES

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Abstract: The growing environmental concerns and the need for sustainable development have driven researchers to focus on the development of eco-friendly, recyclable, and biodegradable materials. Natural fibre-reinforced polymer composites (NFRPCs) have emerged as promising alternatives to synthetic composites due to their low density, high strength-to-weight ratio, renewability, and biodegradability. Among various biodegradable polymers, poly-lactic acid (PLA) stands out for its superior mechanical and physical properties, making it a preferred matrix in green composite fabrication. However, not all NFRPCs are biodegradable, as the biodegradability depends heavily on the type of polymer matrix used. The present work focuses on the mechanical behaviour tensile, flexural, and impact strengths of PLA-reinforced with bamboo fibres. It also discusses the key factors that influence these properties, including fibre type, orientation, treatment, and fibre-matrix adhesion. Addressing these gaps is essential for advancing the application of green composites in engineering and industrial sectors. The outcomes of study revealed that the bamboo fibre-reinforced PLA composites offer an eco-friendly alternative with strong mechanical performance.

Keywords: *Biodegradable, natural fibre, polylactic acid, mechanical behaviour.*

CHARACTERIZATION AND PARAMETER OPTIMIZATION OF PLA/PLA-CF/PLA-HS TO PRODUCT MANUFACTURED BY USING FDM PROCESS

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Abstract: Additive manufacturing (AM), also referred to as 3D printing, allows for the personal creation of items with intricate shapes and capabilities in terms of mechanical and electrical characteristics. AM systems typically employ materials like polymers and composites and are continually progressing across several industrial and developing uses. This work studies have to be analysed the influences of the infill patterns, Printing temperatures and printing speed. In this research PLA, PLA-CF & PLA-HS thermoplastics will be used produce the specimen for the macro behaviour analysis to be manufactured with various process parameter and it will optimize thorough Taguchi design L9 array. (Tensile strength, Hardness, Compression strength & Impact).

Keywords: PLA composites, Fused Deposition Modeling, Material characterization, Process optimization, Mechanical properties.

DEVELOPMENT AND ANALYSIS OF CAMSHAFT WITH ALUMINIUM METAL MATRIX COMPOSITE

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Abstract: Additive manufacturing (AM), also referred to as 3D printing, allows for the personal creation of items with intricate shapes and capabilities in terms of mechanical and electrical characteristics. AM systems typically employ materials like polymers and composites and are continually progressing across several industrial and developing uses. This work studies have to be analysed the influences of the infill patterns, Printing temperatures and printing speed. In this research PLA, PLA-CF & PLA-HS thermoplastics will be used produce the specimen for the macro behaviour analysis to be manufactured with various process parameter and it will optimize thorough Taguchi design L9 array. (Tensile strength, Hardness, Compression strength & Impact).

Keywords: PLA composites, Fused Deposition Modeling, Material characterization, Process optimization, Mechanical properties.

INTEGRATION OF AI, V2X, AND 5G IN NEXT-GENERATION AUTONOMOUS VEHICLES

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Abstract: Automatic driving vehicles are advancing rapidly through the integration of cutting-edge technologies in perception, control, and communication. Modern systems employ LiDAR, radar, high-resolution cameras, and ultrasonic sensors, combined through sensor fusion and AI-driven algorithms, to achieve accurate environment recognition and decision-making. High-definition maps, GPS, and SLAM techniques ensure reliable navigation, while vehicle-to-everything (V2X) communication and 5G connectivity enable real-time coordination and low-latency responses. Edge computing, cybersecurity frameworks, and ethical AI further enhance safety and reliability. These innovations highlight significant progress toward sustainable, intelligent, and autonomous transportation systems that can transform mobility and road safety worldwide.

Keywords: Autonomous Vehicles, Artificial Intelligence (AI), LiDAR and Radar, 5G Connectivity.

BIODIESEL PRODUCTION FROM CALOPHYLLUM INOPHYLLUM OIL USING CALCINED BANANA PEEL ASH AS CATALYST: A SUSTAINABLE WASTE-TO-ENERGY CONVERSION

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Abstract: The expanding energy crisis and environmental threats linked with fossil fuels have boosted the search for renewable and eco-friendly energy alternatives. Biodiesel provides a potential renewable fuel source from non-edible plant oils, and is well-known for its lower emissions and ability to run on diesel engines without major modifications. This current study explored the production of biodiesel from Calophyllum inophyllum (Punnai) oil because it is an under-valued and abundant resource found in Tamil Nadu. Establishing a worthwhile heterogenous catalyst from waste banana peels (i.e., calcined banana peels at 700°C to produce banana peel ash), K-based compounds were successfully extracted and harnessed from the banana peel ash (BPA) catalyst. The transesterification process was optimally performed with methanol-to-oil molar ratio of 9:1, catalyst concentration of 3 wt%, reaction temperature of 60°C, and reaction time of 90 minutes. The produced Punnai Methyl Ester (PME) product was blended with diesel at three different concentrations (B10, B20, B30) and tested in a single cylinder, four-stroke diesel engine under a range of loads and operating conditions. Among the fuel blends tested, B20 demonstrated the best balance between engine performance and emission reductions. A small drop in the brake thermal efficiency occurred when compared to pure diesel; however, meaningful reductions in CO, HC and smoke emissions were recorded with the PME-diesel blends.

Keywords: Transesterification, Punnai oil, Biodiesel, Banana Peel Ash Catalyst, Engine performance.

SOLAR OPERATED FERTILIZER SPRAYER FOR AGRICULTURE PURPOSE

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Abstract: Fertilization and pesticide spraying for plants is principle a part of project in farming. The guide procedure of fertilization and pest spraying have been present for remaining decades. In modern day generation, hand operated machines and heavy engine operated machines are applied for farming. Due to gas call for the economic system hike, the engine operated machines aren't powerful to acquire most yield. Also, the hand operated machines want most manufacturing time and most human effort. By thinking about those problems, the battery-operated sprayer pump is has been added to acquire fertilization and pest spraying. This task describes approximately the multipurpose agro sprayer system which operated with aid of using battery power. Additionally, the strength supply for battery were generated with the aid of using integrating sun system. This system will rectify strength call for agriculture system, pollutants loose and allows for excessive yield.

Keywords: Farming, Pesticide spraying, Battery, High yield.

HYDROGEN ENERGY FOR A SUSTAINABLE FUTURE: A SURVEY

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Abstract: The global transition toward sustainable energy systems has positioned hydrogen as a pivotal element in decarbonization strategies. This survey examines the current state of hydrogen energy technologies, production methods, storage solutions, distribution infrastructure, and applications across various sectors. We analyze the environmental benefits, economic challenges, and technological innovations that characterize the hydrogen economy. Recent advances in electrolysis, fuel cell technology, and green hydrogen production are discussed alongside policy frameworks and market dynamics. The paper identifies critical barriers to widespread adoption and proposes pathways for accelerating the hydrogen transition. Our analysis reveals that while hydrogen presents significant opportunities for achieving carbon neutrality, substantial investment in infrastructure, cost reduction, and standardization remains essential for realizing its full potential in the global energy landscape.

Keywords: Hydrogen energy, renewable energy, fuel cells, electrolysis, energy storage, decarbonization, sustainable development.

DESIGN AND IMPLEMENTATION OF SOLAR-POWERED DEWATERING SYSTEM FOR MINING OPERATIONS

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Abstract: This paper addresses the critical challenge of high energy consumption and operational costs associated with traditional dewatering methods in mining operations. Conventional approaches relying on diesel generators or grid power result in substantial fuel expenses and significant environmental pollution, particularly in remote mining locations. The proposed solution involves designing and implementing an integrated solar-powered dewatering system that harnesses renewable solar energy to operate dewatering pumps. Key design considerations include detailed analysis of site-specific water inflow rates, total dynamic head requirements, solar irradiation data, and component sizing calculations. The implementation methodology encompasses site assessment, system design, component selection, and performance monitoring protocols. Economic analysis demonstrates significant operational cost reduction with a projected payback period of 3-5 years, while environmental impact assessment shows substantial reduction in carbon emissions. The system offers mining operations enhanced energy security, reduced operational costs, and improved environmental sustainability, making it particularly viable for remote mining sites with abundant solar resources. This solar-powered dewatering approach represents a sustainable alternative to conventional methods, aligning with global trends towards cleaner energy solutions in the mining industry while maintaining operational efficiency and reliability.

Keywords: Solar energy, renewable energy, fuel cells, electrolysis, energy storage, decarbonization, sustainable development.

DRONE-ENABLED DATA-DRIVEN SOLUTIONS FOR SUSTAINABLE AGRICULTURE

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Abstract: Sustainable agriculture demands innovative solutions that optimize resource utilization while minimizing environmental impact. This paper presents a drone-enabled, data-driven framework for improving agricultural productivity and sustainability. Unmanned Aerial Vehicles (UAVs) equipped with multispectral and thermal imaging sensors are deployed to collect high-resolution field data in real time. The acquired data is processed using advanced analytics and machine learning algorithms to generate actionable insights on crop health, soil moisture, pest infestation, and nutrient distribution. These insights are further integrated into decision-support systems that guide precision farming practices such as targeted irrigation, optimized fertilizer application, and timely pest control. Field trials and simulation studies demonstrate the effectiveness of drone-assisted data collection and analysis in addressing challenges of scalability, efficiency, and sustainability in modern agriculture. This work highlights the potential of UAV-based data-driven solutions as a key enabler of smart and sustainable farming practices.

Keywords: UAV, production technology, data driven.

MECHANICAL PERFORMANCE STUDY OF NYLON 6,6 FOR ENGINEERING APPLICATIONS

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Abstract: This research provides an extensive experimental analysis of the mechanical behavior of Nylon 6,6 polymer, emphasizing its structural integrity and performance under different loading conditions. Standard test specimens were prepared and evaluated through various mechanical tests, including tensile, impact, hardness, fatigue, and creep tests, following ASTM and ISO standards. These evaluations offer valuable insights into key mechanical properties such as tensile and flexural strength, compressive modulus, water absorption, and Rockwell hardness. Furthermore, the study examines the reinforcement of Nylon 6,6 with advanced graphene-based fillers to improve its strength, stiffness, and thermal characteristics. Reinforcement materials such as carbon fiber, jute, glass fiber, carbon nanotubes (CNTs), aramid fibers, and graphene nanoplatelets were selected for their exceptional thermal and electrical conductivity and high modulus values ranging from 208 GPa to 650 GPa. By correlating experimental findings with existing literature, the study enhances understanding of Nylon 6,6’s suitability for engineering applications such as gears, structural parts, and other industrial components that require high strength, wear resistance, and thermal stability. The outcomes offer a valuable foundation for future advancements in polymer composite research within the field of materials science and mechanical engineering.

Keywords: Nylon 6,6 Polymer, Mechanical Properties, Graphene Reinforcement, Polymer Composites, Tensile Strength, Thermal Stability, Wear Resistance, Engineering Applications.

MATERIAL INVESTIGATION AND TOPOLOGY OPTIMIZATION OF AGRICULTURE DRONE FRAMES

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Abstract: Drones are being used more and more in agriculture for precision farming operations like field analysis, crop monitoring, and spraying. The frame design of these drones is crucial to their performance; it needs to be strong and lightweight to support heavy payload and challenging field conditions. The material research and structural optimization of agricultural drone frames are the main objectives of this project. The strength, density, durability, and resistance to the environment of the candidate materials—which include composites, lightweight alloys, and polymers—will be assessed. Static structural analysis for load-bearing capacity and modal analysis to evaluate vibration characteristics and natural frequencies essential for flight stability will be conducted using finite element analysis (FEA). Additionally, the frame shape will be improved by topology optimization, which will reduce weight without sacrificing stiffness or strength. Delivering a high-performance drone frame with improved durability, payload capacity, and dependability for sustainable agricultural operations is the goal of the combined study of material selection and optimization approaches.

Keywords: Natural fiber, composite materials, mechanical strength.

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IMPACT OF AI IN RURAL DEVELOPMENT OF TAMILNADU

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Abstract: Artificial Intelligence (AI) is rapidly transforming socioeconomic landscapes worldwide. In Tamil Nadu a state with a diverse mix of agriculture, small-scale industry, fisheries, and growing digital infrastructure — AI has the potential to accelerate inclusive rural development. This paper examines how AI-driven technologies like precision agriculture, supply-chain optimization, predictive maintenance, healthcare diagnostics, skill-matching platforms, and local-language digital assistants can raise productivity, reduce risk, and improve access to services in rural Tamil Nadu. We evaluate benefits through improved yields, reduced post-harvest loss, increased market access, and better health and education outcomes. The paper also highlights barriers: digital divide, data gaps, affordability, trust, and governance. We propose a phased implementation roadmap centered on community engagement, low-bandwidth AI solutions, public-private partnerships, and reproducible pilots in key agro-ecological zones. Finally, we recommend concrete impact metrics and policy measures to ensure AI contributes to equitable and sustainable rural development in Tamil Nadu.

Keywords: Artificial Intelligence, rural development, precision agriculture, digital inclusion, healthcare, supply chain, public policy.

THE ROLE OF ARTIFICIAL INTELLIGENCE IN MODERN MATHEMATICAL COMPUTATION AND OPTIMIZATION

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Abstract: The integration of Artificial Intelligence (AI) with mathematical computation has redefined the process of optimization, modeling, and decision-making. Traditional mathematical methods are now enhanced by AI techniques such as machine learning, neural networks, and genetic algorithms, allowing for faster and more intelligent problem-solving. This paper explores how AI-based approaches improve the accuracy, adaptability, and efficiency of mathematical computations in engineering, operations research, and real-world optimization tasks.

Keywords: Artificial Intelligence (AI), Machine Learning, Deep Learning, Optimization, Fuzzy Logic, Genetic Algorithm, Neural Networks, Mathematical Modelling, Decision Making, Data Analysis, Computation, Hybrid Algorithms, Predictive Analytics.

SUSTAINABLE HEALTHCARE THROUGH AI-INTEGRATED TEXTILE AND DESIGN INNOVATIONS

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Abstract: The integration of Artificial Intelligence (AI) with textile technology and design is opening new possibilities for sustainable healthcare solutions. Smart textiles embedded with sensors and actuators can monitor vital signs, support rehabilitation, and provide patient comfort, while AI enables real-time data processing, predictive analysis, and personalized healthcare interventions. Design innovations ensure that these products remain user-friendly, sustainable, and adaptable to diverse needs. Together, these advancements contribute to reducing hospital burden, promoting preventive healthcare, and ensuring eco-friendly production practices. This paper highlights the role of AI-driven smart textiles in healthcare monitoring, therapeutic applications, and sustainable design, while also discussing challenges such as scalability, ethical issues, and user acceptance. The interdisciplinary approach of combining AI, textiles, and design offers a pathway toward a sustainable healthcare ecosystem that enhances quality of life.

Keywords: Artificial Intelligence, Design Innovations, Smart Textiles, Sustainable Healthcare

PHYTOCHEMICAL EXTRACTION, SPECTRAL ANALYSIS, AND BIOLOGICAL ACTIVITIES OF YELLOW POINCIANA

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Abstract: A comprehensive review of the literature on *Peltophorum pterocarpum* (DC.) K. Heyne reveals that this species possesses remarkable pharmacological and physiological properties, along with diverse potential applications. The broad spectrum of biological activities associated with *P. pterocarpum* prompted the present investigation into its floral constituents for the isolation of novel bioactive compounds. In this study, an efficient protocol was developed for the extraction and isolation of compounds from the flowers of *P. pterocarpum*. TLC was performed on glass plates coated with silica gel 60 (E. Merck, India Ltd.), while GC–MS analysis was conducted on a Hewlett-Packard 6890/5973 instrument operating at an ionization energy of 1000 eV and equipped with an HP-5 capillary column. The isolated compound(s) were subsequently evaluated for antibacterial and antifungal activities against selected microbial species, using standard drugs as reference controls. The findings highlight the potential of *Peltophorum pterocarpum* flowers as a promising natural source of bioactive molecules with significant antimicrobial properties.

SUSTAINABLE REMOVAL OF SYNTHETIC DYES USING CORN COB-BASED ADSORBENT: AN EXPERIMENTAL STUDY

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Abstract: Corn cob, an abundantly available and cost-effective agricultural waste, was utilized as a natural adsorbent for the removal of malachite green dye from aqueous solutions. The main objective of this study was to investigate the adsorption of synthetic dye effluent using corn cob as a sustainable alternative to conventional chemical adsorbents, thereby minimizing environmental pollution. Batch adsorption experiments were conducted in the liquid phase to study the effects of adsorbent dosage, contact time, and particle size on dye removal efficiency. Dye samples were periodically collected, centrifuged, and analyzed using UV-Visible spectroscopy to determine the extent of adsorption. The results revealed that corn cob exhibited significant adsorption capacity, and the optimum conditions for maximum dye removal were established. This study demonstrates that corn cob can serve as an efficient, low-cost, and eco-friendly adsorbent for the treatment of dye-contaminated wastewater.

Keywords: Corn cob, Adsorption, Malachite green, UV analysis.

MATERIAL INVESTIGATION AND TOPOLOGY OPTIMIZATION OF AGRICULTURE DRONE FRAMES

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Abstract: Drones are being used more and more in agriculture for precision farming operations like field analysis, crop monitoring, and spraying. The frame design of these drones is crucial to their performance; it needs to be strong and lightweight to support heavy payload and challenging field conditions. The strength, density, durability, and resistance to the environment of the candidate materials—which include composites, lightweight alloys, and polymers—will be assessed. Static structural analysis for load-bearing capacity and modal analysis to evaluate vibration characteristics and natural frequencies essential for flight stability will be conducted using finite element analysis (FEA). Additionally, the frame shape will be improved by topology optimization, which will reduce weight without sacrificing stiffness or strength. Delivering a high-performance drone frame with improved durability, payload capacity, and dependability for sustainable agricultural operations is the goal of the combined study of material selection and optimization approaches.

Keywords: Natural fiber, hybrid composites, mechanical strength.

AI IN HEALTHCARE

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Abstract: Abstract Artificial Intelligence (AI) is rapidly transforming the healthcare industry by enhancing the accuracy, efficiency, and accessibility of medical services. AI-powered systems are now widely applied in diagnostics, medical imaging, drug discovery, personalized treatment planning, predictive analytics, and robotic-assisted surgeries. These technologies enable early disease detection, reduce human error, accelerate research, and improve patient outcomes, while also lowering healthcare costs. Despite its potential, the integration of AI into healthcare faces challenges such as data privacy concerns, algorithmic bias, regulatory hurdles, and ethical considerations. As advancements continue, the future of AI in healthcare lies in human-AI collaboration, precision medicine, and real-time patient monitoring, ultimately creating a more proactive, patient-centered, and data-driven healthcare ecosystem.

Keywords: Artificial Intelligence

AI TOOLS FOR SENTIMENT ANALYSIS

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Abstract: The exponential growth of digital communication has generated vast amounts of opinionated text in the form of social media posts, product reviews, online forums, and blogs. Understanding this data is crucial for businesses, policymakers, and researchers. Sentiment analysis, powered by Artificial Intelligence (AI), enables machines to detect emotions, opinions, and attitudes in human language with increasing accuracy and efficiency. Over the years, sentiment analysis has evolved from lexicon-based systems to advanced transformer-based deep learning models that provide context-aware predictions. This document examines the fundamentals of sentiment analysis, existing systems, popular AI tools, practical applications, challenges, and future directions. It highlights the role of sentiment analysis in bridging the gap between human emotions and machine interpretation, ensuring its growing relevance in society.

Keywords: Artificial Intelligence, Sentiment Analysis, Opinion Mining, Natural Language Processing (NLP), Machine Learning

POWERED SENTIMENT ANALYSIS FRAMEWORK FOR EARLY MENTAL HEALTH DETECTION AMONG STUDENTS

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Abstract: The proposed model employs transformer-based architectures such as BERT (Bidirectional Encoder Representations from Transformers) and deep learning algorithms to analyze text and classify emotions such as happiness, sadness, fear, anger, anxiety, and stress. Preprocessing techniques like tokenization, lemmatization, and stop-word removal will be utilized to prepare datasets for efficient training. Publicly available emotional and psychological text datasets will be used to train and validate the model's performance. The system will then generate emotion distribution scores and alert patterns that may indicate the early onset of mental health struggles in students.

Keywords: Artificial Intelligence, Sentiment Analysis, Opinion Mining, Natural Language Processing (NLP)

AI-ENHANCED CAD FOR SUSTAINABLE PRODUCT DESIGN: A PREDICTIVE AND IMMERSIVE APPROACH

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Abstract: Sustainable product design has emerged as a critical priority across industries in response to growing environmental concerns, regulatory pressures, and consumer demand for eco-friendly solutions. Traditional Computer-Aided Design (CAD) systems, while effective in modeling and visualization, often lack integrated tools to evaluate sustainability parameters during the early stages of product development. This research introduces an AI-enhanced CAD framework that combines predictive analytics and immersive technologies to address this gap and enable next-generation sustainable design practices. The framework leverages Artificial Intelligence (AI) algorithms to optimize material selection, energy efficiency, and design performance by predicting environmental impacts across the product lifecycle. Predictive analytics enables the identification of patterns in design decisions, forecasting long-term sustainability outcomes, and suggesting alternatives that minimize waste and carbon footprint. By embedding these intelligent insights directly into the CAD environment, designers are empowered to make data-driven choices without compromising creativity or functionality. Complementing predictive analytics, immersive technologies such as Virtual Reality (VR) and Augmented Reality (AR) are integrated into the design workflow.

Keywords: Artificial Intelligence, Computer-Aided Design, Sustainable Product Design, Predictive Analytics, Immersive Technologies

Enhancing Cloud Security: A Comprehensive Approach to Mitigating Risks

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Abstract: Cloud computing has revolutionized the way businesses store, process, and manage data. However, this shift has introduced new security challenges that must be addressed to ensure the confidentiality, integrity, and availability of data. This paper explores the key problems in cloud security, including data breaches, compliance complexities, and misconfigurations. It requires periodic refreshing to maintain data Integrity. It also outlines potential solutions such as encryption, access control, continuous monitoring, and employee training. The goal is to provide a comprehensive understanding of cloud security challenges and highlight the importance of a proactive and collaborative approach to safeguarding cloud-based systems.

Keywords: Encryption, Access control, Cloud governance , risk management, incident response.

DEEP LEARNING–DRIVEN PREDICTION OF THE DOM-CHROMATIC NUMBER IN COMPLEX GRAPHS

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Abstract: The intersection of classical graph theory and modern artificial intelligence has emerged as a promising frontier for uncovering complex structural insights within networks. In this paper, we introduce a Deep Learning–driven analytical paradigm for the exploration and estimation of the dom-chromatic number $\gamma_{dc}(G)$ of a graph $G=(V,E)$. A dom-coloring set is defined as a dominating set that encompasses at least one vertex from each color class under a given χ -coloring of G . Traditional combinatorial approaches often struggle to determine $\gamma_{dc}(G)$ for large-scale or dynamically evolving graphs due to their inherent computational complexity. The proposed model learns deep latent representations that capture the intricate interplay between chromatic and domination characteristics, thereby enhancing predictive precision and generalizability. Extensive experiments on benchmark graph datasets substantiate the efficacy of our framework, demonstrating superior performance in terms of scalability, convergence rate, and estimation accuracy when compared to conventional deterministic algorithms.

Keywords: Deep Learning; Graph Neural Networks (GNNs); Dom-chromatic number; Graph Coloring; Domination Number; Reinforcement Learning; Computational Graph Theory; Intelligent Systems

DESIGN OF ROBOTIC VISION BASED DOMESTICALLY-DEVELOPED COMBINED RAIL SURVEILLANCE SYSTEM USING MACHINE LEARNING

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Abstract: The safety and efficiency of national railway networks are critically dependent on real-time, accurate track monitoring. This paper presents the design and development of a Domestically-Developed Combined Rail Surveillance System (D-CRSS) that leverages robotic vision and machine learning (ML) to transition from labor-intensive manual inspections to a high-speed, automated, and non-contact monitoring solution. The D-CRSS integrates multiple imaging sensors, including high-resolution cameras and LiDAR, mounted on an inspection vehicle. The core of the system is an advanced deep learning model, specifically a tailored Convolutional Neural Network (CNN) architecture, trained on a massive, diverse dataset of railway images to perform two critical functions: defect classification (e.g., fastener presence/absence, rail crack detection, ballast degradation) and component measurement (e.g., track geometry and rail wear). The key innovation lies in the synergistic integration of domestic hardware and an optimized ML pipeline designed for the unique environmental and operational challenges of the local rail network.

Keywords: ML pipeline, Convolutional Neural Network

AI-ENABLED PREDICTIVE ANALYTICS FOR ENHANCING CANCER DIAGNOSIS AND PATIENT CARE

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Abstract: Artificial Intelligence (AI) has emerged as a transformative technology in healthcare, particularly in oncology, where early and accurate diagnosis significantly impacts treatment success and patient survival. This paper presents an AI-enabled predictive analytics framework aimed at enhancing cancer diagnosis, prognosis, and patient care. The proposed system integrates advanced machine learning and deep learning algorithms to analyze heterogeneous data sources, including medical imaging, genomic sequences, pathology reports, and electronic health records. Predictive models based on Convolutional Neural Networks (CNNs), Gradient Boosting, and Long Short-Term Memory (LSTM) networks are employed to identify cancerous patterns, predict disease progression, and recommend personalized treatment strategies.

Keywords: Artificial intelligence, predictive analytics, cancer diagnosis, deep learning, machine learning

TRANSFORMATIVE EFFECTS OF AI INTO TEXTILE DESIGN AND DEVELOPMENT

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Abstract: The integration of Artificial Intelligence (AI) in textile design is redefining creative workflows by merging tradition with advanced digital innovation. This textile designing is revolutionizing the way yarns, fabrics, patterns, and apparels are conceptualized, developed, and brought to market. The overview of the study highlights AI as a vital tool in sustainable fashion development, where creativity, heritage, and technology converge to shape the future of textile design. In this study, traditional painting motifs were reinterpreted into contemporary textile patterns through AI-assisted design tools, driven by rapid advances in machine learning, computer vision, and generative AI, the field at present witnesses unprecedented levels of automation, precision, and customization.

Keywords: Artificial intelligence, Textile design, Generative AI, Pattern generation, Fabric simulation, Digital prototyping, Sustainable design.

STRATEGIES TO OPTIMIZE BATTERY OPERATION TO MINIMIZE THE ELECTRICITY COST IN A MICROGRID WITH RENEWABLE ENERGY SOURCES AND ELECTRIC VEHICLE

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Abstract: The growing integration of renewable energy sources (RES) and electric vehicles (EVs) in modern microgrids presents new opportunities for sustainable and resilient energy systems, while also introducing challenges in energy management and battery optimization. This paper proposes an intelligent, sensor-driven approach for optimizing battery operations in microgrids with dynamic RES and EV participation. Smart sensors continuously monitor parameters such as energy generation, load demand, battery state-of-charge, and EV usage to enable real-time adaptive control and predictive decision-making. The proposed system enhances cost efficiency, reliability, and battery health while maximizing renewable energy utilization. This holistic framework demonstrates a scalable solution for next-generation microgrid management, integrating real-time data analytics and advanced control strategies to support cleaner and smarter energy networks

Keywords: Renewable energy sources, Electric vehicles, Microgrid, Battery optimization, Smart sensors, Real-time control, Energy management, Data analytics, Predictive control, Sustainable energy systems

HISTORICAL ROOTS OF MATHEMATICAL MODELING IN MEDICINE

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Abstract: The application of mathematical modeling in healthcare is largely perceived as a modern phenomenon, yet its foundational principles trace back to the ancient world. This abstract explores the nascent forms of quantitative thinking that influenced healthcare in ancient Egypt and Greece, arguing that while lacking contemporary formalisms, the methods of ancient physicians relied on pattern recognition, data collection, and predictive analysis—core components of mathematical modeling. In ancient Egypt, medical texts such as the Edwin Smith and Ebers papyri reveal a structured methodology for diagnosis and treatment. By identifying recurring patterns in diseases, Egyptian physicians engaged in a qualitative abstraction that parallels modern epidemiology. The intersection of mathematics and medicine became more explicit in ancient Greece. The Pythagorean School introduced a quantitative worldview, positing that numbers held the key to understanding the human body. The subsequent Hippocratic school, while eschewing mysticism, championed a rational and observational approach. Their emphasis on prognosis, based on the meticulous observation of a disease's anticipated progression, suggests a form of predictive modeling. In conclusion, the healthcare practices of antiquity were not devoid of modeling principles. The systematic data collection of the Egyptians and the predictive, rational medicine of the Greeks underscore an early desire to bring order and predictability to human health. These ancient endeavors represent the intellectual genesis of a discipline that continues to evolve, demonstrating that the quest to quantify the human condition is a timeless pursuit.

Keywords: *Mathematical Modeling, Ancient Healthcare, History of Medicine, Quantitative Reasoning, Hippocratic Medicine, Egyptian Papyri, Prognosis, Predictive Analysis, Pattern Recognition, Medical History.*

RESULTS ON G-METRIC SPACE

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Abstract: In this paper, we introduce a new results of fixed point theorems using the generalized contractions on G-metric space. Then, modify the proof of a theorem for a self-map f on a G-metric space (X, d) of Mustafa et al (2008) in terms of the boundedness of the f -orbit and then establish an interesting consequence that the obtained unique fixed point p of f will be its G-contractive fixed point in the sense that the orbit $x, fx, f^2x, \dots, f^nx, \dots$ at each $x \in X$ is G-convergent with limit p .

Keywords: *G-Metric Space, G-Cauchy Sequence, Fixed Point, G-contractive Fixed Point*
 2010 AMS Mathematics Subject Classification: 54 H 25

MEDIAN BASED MODIFIED RATIO ESTIMATORS FOR THE ESTIMATION OF FINITE POPULATION MEAN WITH KNOWN MEDIAN AND QUARTILES

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Abstract: The present study proposes a set of modified ratio estimators based on ratio-cum-median approaches for estimating the finite population mean. These estimators are developed using linear combinations of known auxiliary variable parameters such as the median and quartiles of the auxiliary variable. The efficiency of the proposed estimators is evaluated both algebraically and numerically, and the results are compared with those of the sample mean and the classical ratio estimator under simple random sampling without replacement (SRSWOR). Numerical investigations reveal that the proposed estimators consistently outperform both the traditional ratio estimator and the sample mean, demonstrating their superior efficiency in estimating the population mean.

Keywords: Auxiliary variable; Bias; Mean squared error; Natural population; Percentage relative efficiency; Simple random sampling.

REVOLUTIONIZING WOUND CARE WITH ARTIFICIAL INTELLIGENCE: PROGRESS AND PROMISE OF INTELLIGENT MEDICAL TEXTILES

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Abstract: Artificial Intelligence (AI) rapidly transforms the landscape of healthcare and medical textiles, propelling new solutions in wound care, diagnosis, and patient monitoring. Contemporary advances have led to the emergence of smart wound dressings that integrate biosensors and intelligent textile fibers, enabling real-time continuous assessment of critical wound health indicators pH, temperature, moisture, and exudate volume. These textile-based platforms leverage AI-driven data analytics to interpret physiological data at the point of care, facilitating personalized healing strategies, proactive complication prevention, and dynamic clinical decision-making based on timely, patient-specific trends. Recent breakthroughs demonstrate the powerful synergy between textile engineering, computational modeling, and machine learning. Researchers now design highly adaptive, antimicrobial, and biocompatible dressings that are responsive to evolving patient needs, with AI algorithms optimizing material selection and functional performance simulations for targeted applications.

Keywords: Artificial Intelligence, Medical Textiles, Wound Care, Healthcare Innovation.

REAL-TIME AI MONITORING OF PUBLIC WATER BODIES USING FLOATING SENSOR DRONE

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Abstract: Urban water bodies such as lakes, rivers, and ponds are under constant threat from pollution caused by industrial discharge, sewage leakage, and agricultural runoff, resulting in deteriorating water quality and associated risks to public health and biodiversity. Traditional water monitoring techniques, which rely on manual sampling and laboratory analysis, are slow, labor-intensive, and incapable of delivering timely data required for effective environmental management in smart cities. This paper proposes an innovative solution utilizing floating sensor drones equipped with advanced water quality sensors to autonomously collect parameters including pH, turbidity, temperature, and chemical contamination markers in real time. These drones are integrated with IoT technology, enabling the wireless transmission of continuous data streams to a centralized cloud platform. Leveraging artificial intelligence and machine learning models, the system analyzes incoming data for anomaly detection, pollution prediction, and early identification of algal bloom events. The AI-driven approach offers pattern recognition and predictive analytics, empowering municipal authorities to enact prompt interventions and policy responses.

Keywords: Real-time monitoring, Floating sensor drone, Water quality, Artificial intelligence, IoT, Pollution detection, Algal bloom prediction

AUTONOMOUS PRECISION AGRICULTURE: AN AI AND ROBOTIC VISION SYSTEM FOR TARGETED PESTICIDE APPLICATION

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Abstract: Traditional agriculture relies on blanket pesticide spraying, leading to excessive chemical use, environmental damage, and increased operational costs. This paper presents an innovative solution for precision crop protection through the design and implementation of an Autonomous Precision Agriculture (APA) system, exemplified by the SPID (SMART PESTICIDE INFECTION-BASED DISPENSER) concept. The robotic platform uses a sophisticated vision module, combining high-resolution RGB and multi-spectral sensors, to capture detailed, multi-layered data on plant health. This data is fed into an on-board AI processor running a Convolutional Neural Network (CNN) model trained for instance segmentation and disease classification. The CNN accurately identifies, localizes, and classifies specific pests or diseases on a plant, even in their early stages. The AI then serves as a smart dispensing decision-maker, calculating the precise chemical type and minimal effective dosage.

IOT-ENABLED SOLAR-POWERED ONION STORAGE SYSTEM

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Abstract: Onion storage faces significant challenges due to high post-harvest losses caused by uncontrolled humidity, temperature fluctuations, and microbial spoilage. This project presents an IoT-enabled, solar-powered intelligent storage system designed to maintain ideal environmental conditions for onion preservation. The system integrates temperature, humidity, and gas sensors connected to a microcontroller that continuously monitors real-time parameters. Data analytics and AI-based control logic automatically regulate fans, vents, and UV-C sterilization to suppress microbial growth and reduce rot and sprouting. The entire unit operates on renewable solar energy, ensuring sustainable performance even in rural, off-grid regions. Incorporating insights from recent microbiological research on fungal and bacterial pathogens of onions, the solution enhances shelf life while minimizing energy use and chemical intervention. By combining smart sensing, clean energy, and scientific storage design, this model provides a scalable, low-cost, and environmentally responsible approach to post-harvest onion management—supporting both farmer profitability and food security.

TOPOLOGICAL DATA ANALYSIS BY MACHINE LEARNING APPROACHES – A COMPREHENSIVE REVIEW

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Abstract: Topological data analysis (TDA) in machine learning is a powerful approach that extracts insights from complex datasets by analyzing their topological features. By integrating TDA with machine learning, researchers can identify patterns and relationships within data that may not be apparent through traditional methods. TDA has been applied in various fields, including graph classification, biomedical informatics, and time series analysis. Some notable applications of TDA include Graph Classification which improves graph classification tasks by extracting topological features that provide supplementary information to traditional graph features. In Biomedical Informatics TDA concepts applied for biomedical informatics to analyze complex biological systems and identify potential biomarkers. In Time Series Analysis TDA can analyze time series data to detect patterns and anomalies. In Quantum Systems TDA has been used to study quantum phase transitions and identify topological features in quantum systems. This article presents the various applications of TDA and how the machine learning algorithms implemented to reach and achieve the goals through TDA are reviewed. This approach will help us to understand the concepts of TDA in analysis the real life problems and solution implementation along with the adoption of the modern technologies.

A NOTE ON FUZZY Q-TOPOLOGICAL ACTION OF GROUP AND SUBGROUP

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Abstract: In this paper, we present the concept of the fuzzy Q-Topological action of a group and explore its various properties. We also examine several fuzzy relations associated with the fuzzy Q-Topological action of the group. Furthermore, we study the fuzzy Q- Topological orbit arising from such an action and analyze its related properties. Additionally, we introduce the fuzzy Q-Topological action of a subgroup and investigate its corresponding theorems and properties within the framework of a fuzzy Q-Topological group. The concept of a normal fuzzy Q-Topological action of a subgroup is also discussed in detail. Moreover, we consider homomorphic functions within the context of fuzzy Q-Topological actions under a subgroup, and finally, we present several theorems and properties concerning homomorphisms in the fuzzy Q-Topological action of a subgroup.

Keywords: Fuzzy Q-Topology, Group, Subgroup, BRK Algebra

INSILICO DRUG DESIGNING FOR CANCER (PROTEIN KINASE)

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Abstract: To find possible inhibitors of Anaplastic Lymphoma Kinase (ALK), a crucial target in non-small cell lung cancer, this study used in silico drug design. Molecular docking, ADME profiling, and structure-based modeling were used to assess five ligands: alexinib, lorlatinib, amantadine, bragitinib, and ceretinib. The strongest binding affinities and advantageous pharmacokinetic profiles were found in Lorlatinib and Alectinib, which is in line with their clinical efficacy. The results show how useful computational methods are for identifying the best ALK inhibitors and directing the development of next-generation medications.

INSILICO DRUG DESIGNING FOR CANCER (PROTEIN BRAF)

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Abstract: Because it allows for the computational identification and optimization of bioactive molecules prior to laboratory synthesis, in-silico drug design has emerged as a key element of drug discovery. To forecast drug-target interactions and enhance lead compound design, it uses dynamics simulations, docking, virtual screening, molecular modeling, and ADME/T profiling. The BRAF protein kinase, especially its V600E mutant form, is a significant therapeutic target for uterine cancer because of its involvement in tumor growth and the MAPK/ERK signaling pathway. Ibuprofen, pergolide, tetrandrine, miconazole nitrate, and oxytetracycline are some of the compounds that are being repurposed in this study in order to potentially inhibit BRAF kinase. In order to determine binding affinity and complex stability, these molecules—which have a variety of pharmacological origins—will be assessed using dynamics simulations, molecular docking, and structure-based virtual screening. ADMET profiling will further be applied to estimate pharmacokinetic behavior and toxicity, supporting the identification of candidates for therapeutic development in uterine cancer.

EXTRACTION OF KERATIN FROM WASTE BIOMASS OF HUMAN HAIR AND EGGSHELL FOR THE FABRICATION OF BIOPLASTIC

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Abstract: Plastic bags and plastic product, derived from petroleum-based high-density polyethylene, have become integral to modern lifestyles, leading to widespread environmental concerns due to their persistence in landfills. Plastic offers a variety of benefits, in a variety of shapes, such as sheets, panels, film, which can all be flexible as the application requires. Humans are also affected by plastic pollution, such as through the disruption of the thyroid hormone axis or hormone levels. Thus, the biodegradable plastic becomes a promising solution to solve all these problems. Importantly, these bio-plastics demonstrated biodegradability in tests, highlighting their potential as a sustainable alternative to traditional plastics derived from fossil fuels. This research successfully synthesized bio-plastics using keratin from human hair and eggshell samples. The addition of glycerol influenced the tensile strength and elongation at break, enabling control over these properties. Films with 2 wt% glycerol exhibited optimal mechanical and thermal characteristics, as well as homogeneous surfaces. SEM tests confirmed compatibility and absence of defects. These bio-plastics are biodegradable and offer a promising alternative to environmentally harmful fossil oil-based materials.

Keywords: Bioplastic, Keratin, Eggshell Waste, Homogeneous Surfaces, Tensile Strength, SEM, FTIR, TGA, XRD

IMPLEMENTING AI IN NATURAL FIBRE COMPOSITE MANUFACTURING TECHNOLOGY WITH DIGITAL TWIN MODEL SIMULATIONS

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Abstract: Artificial intelligence (AI) is increasingly transforming the landscape of natural fibre composite manufacturing by enhancing process efficiency, product quality, and sustainability. This abstract explores how AI-driven approaches such as machine learning algorithms and process optimization techniques facilitate precise quality control, predictive maintenance, and adaptive manufacturing in natural fibre composites. The integration of AI enables real-time monitoring, reduces material waste, and streamlines production cycles, presenting new opportunities for innovation and environmental impact reduction within the industry. Implementing Their inherent variability in mechanical and physical properties presents challenges in achieving consistent composite performance AI offers a predictive, data-driven framework to optimize material selection, processing parameters, and quality control, reducing the dependence on trial-and-error methods.

Keywords: Artificial Intelligence, Natural Fibre Composites, Process Optimization, Sustainability

SYNERGISTIC SURFACE INTERACTIONS AND STRUCTURAL COUPLING IN MULTI-METAL OXIDE BIFUNCTIONAL ELECTROCATALYSTS FOR OVERALL WATER SPLITTING

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Abstract: Efficient OER and HER electrocatalysts remain a major challenge in advancing sustainable energy technologies, particularly for developing high-activity electrodes suitable for large-scale use. In this study, a hierarchical bifunctional electrode composed of one-dimensional (1D) Cu–Co oxide nanorods grown on two-dimensional (2D) NiO nanosheets is presented. The interconnected Cu–Co nanorods form a flower-like structure, enhancing surface area and active site exposure. The integrated 1D Cu/Co–2D NiO architecture exhibits excellent performance with low overpotentials (<100 mV for HER and <300 mV for OER at 30 mA cm⁻²). NiO serves as a conductive platform that accelerates electron transfer, while the hierarchical architecture and mixed surface wettability promote efficient mass transport and gas release. The assembled electrolyzer achieves 10 mA cm⁻² at a low cell voltage of 1.55 V in 1 M KOH.

Keywords - CuCo-Oxide, Electro catalysts, 2D nanosheets, bifunctional and water electrolysis.

SAFEMIND - AN AI-POWERED WELLNESS PLATFORM FOR WOMEN AND CHILDREN

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Abstract: Women and children represent two of the most vital yet vulnerable segments of society, often facing challenges related to healthcare accessibility, timely diagnosis, and personalized wellness guidance. The project titled “An AI-Powered Wellness Platform for Women and Children” aims to develop an intelligent digital platform that leverages Artificial Intelligence (AI) and Data Analytics to monitor, assess, and improve overall physical and mental well-being. The platform will utilize machine learning algorithms to analyze user data, track wellness progress, and predict potential health risks. Special features include maternal health monitoring, child growth tracking, and mental wellness support through guided counseling modules. The system also offers real-time alerts, teleconsultation options, and data privacy assurance, making it a comprehensive and user-friendly solution. By combining technology with empathy, the project envisions creating a smart wellness ecosystem that empowers women and children to take proactive control of their health.

Keywords - Artificial Intelligence, Women and Child Health, Wellness Platform, Machine Learning, Preventive Healthcare

ASSESSING THE IMPACT OF ARTIFICIAL INTELLIGENCE ON SECOND LANGUAGE ACQUISITION

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Abstract: Language plays an important role in our world. Globally, over 2,500 languages are spoken, each holding cultural and historical significance. Native speakers with strong knowledge of their language are key to preserving and promoting it. Unfortunately, some languages are becoming endangered because native speakers are no longer actively using them. In the modern era, most students have access to AI technology and mobile phones, giving them a wide range of learning resources at their fingertips. However, only a few students are effectively utilizing these tools. Many are unable to do so, often due to low language proficiency or limited influence from their native language. In India, English is widely taught as a second language, and many students attend English-medium schools. Despite this, fluency in spoken English remains a challenge for many learners. This study aims to assess the differences between students who use AI tools effectively and possess adequate language knowledge, and those who do not.

**FOCUS ENGINEERING FOR TIGHTLY FOCUSED PHASE MODULATED
VECTOR LASER BEAM**

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Abstract: The tight focusing properties of a phase-modulated polarized vector beam are theoretically analyzed using vector diffraction theory. This analysis enables a detailed understanding of how the beam behaves when focused through a high numerical aperture (NA) lens system. The study involves the computation of electric and magnetic field intensities as well as the Poynting vector distribution in the focal region, providing insight into the energy flow and polarization dynamics near the focus. The results reveal that phase modulation significantly influences the focal field distribution, allowing control over the shape, size, and symmetry of the focal spot. Such control is particularly advantageous in advanced optical applications, including optical trapping, particle manipulation, high-resolution imaging, and laser micro-fabrication, where precise spatial control of light intensity and polarization is crucial.

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