International Conference on Recent Trends in Technology

Departments of AI&DS, CSE, ECE, EEE, and IT

Theni Melapettai Hindu Nadargal Uravinmurai

NADAR SARASWATHI COLLEGE OF ENGINEERING & TECHNOLOGY

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai
Accredited by NAAC with 'A' Grade ; An ISO 9001 : 2015 Certified Institution
Vadapudupatti, Annanji(po), Theni - 625531.

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978-93-342-9519-1

"ICRTT - 2k25"

International Conference on Recent Trends in Technology

Organizing Departments: **ECE, EEE, CSE, AI&DS, and IT**

Email :iccrtt@nscet.org

Book of Proceedings

"ICRTT - 2k25"

02.05.2025

Nadar Saraswathi College of Engineering & Technology

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ABOUT TMHNU

"Genesis of Theni Melapettai Hindu Nadargal Uravinmurai Since 1898"

Theni Melapettai Hindu Nadargal Uravinmurai (TMHNU) proclaims to society its tremendous service in providing quality education. The pioneers of TMHNU (1898) started the primary school in 1919, named Nadar Saraswathi Vidhyasala, with 38 students and 2 teachers. Now, that small seed has flourished into a large tree. With the blessings of Annai Sri Bathrakaliamman, 17 educational institutions now function under this bower, providing quality education. Over 22,000 students study here, with more than 1,000 teaching and 1,000 supportive staff members.

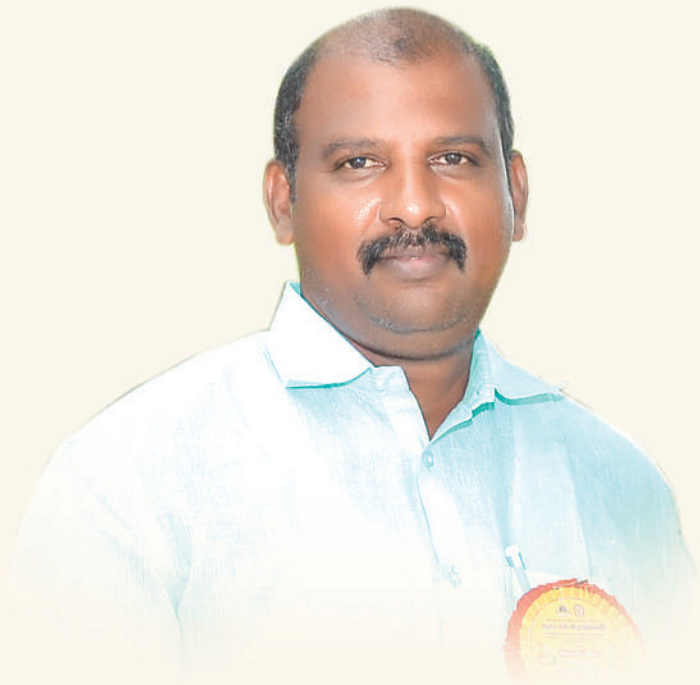
GOVERNING CELL OF TMHNU

President

Mr. T. Rajamohan, B.Sc.,

It gives me immense pleasure to welcome all participants to ICRTT-2025. As technology advances at an unprecedented pace, platforms like this conference become vital for exchanging ideas, innovations, and inspirations. I extend my best wishes to all the researchers, scholars, and technologists who have gathered here to explore the Recent Trends in Technology. May this event spark collaborations that lead to transformative solutions for a better tomorrow.

GOVERNING CELL OF TMHNU



Vice President

Mr. P.P. Ganesh, B.Sc.,

It is with great pride that I address you at ICRTT-2025. This conference stands as a testament to our commitment to fostering innovation and promoting a culture of research. The theme Recent Trends in Technology challenges us to stay updated and agile in an ever-evolving world. I congratulate the organizing team and wish all delegates an enriching and memorable experience.

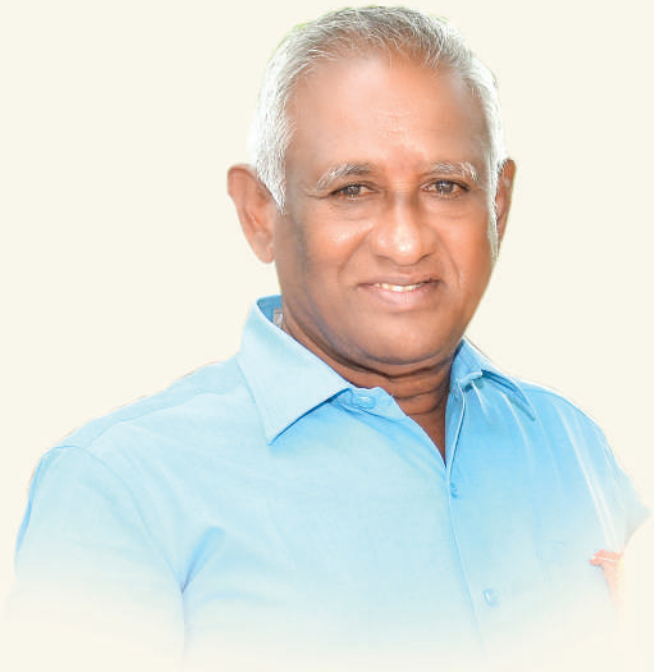
GOVERNING CELL OF TMHNU

General Secretary

Mr. M.M. Anandhavel,M.B.A.,

I extend a warm welcome to all esteemed guests, scholars, and participants at ICRTT-2025. In the spirit of discovery and collaboration, this conference aims to bridge the gap between academia and industry, reflecting on the emerging trends shaping our future. I encourage all participants to engage, question, and collaborate to maximize the outcomes of this gathering.

GOVERNING CELL OF TMHNU



Treasurer

Mr. M.Palaniappan

On behalf of the organizing committee, I am honored to welcome you to ICRTT-2025. Managing the resources for a conference of this scale has been both challenging and rewarding. I thank our sponsors, partners, and contributors for their generous support. May this event, centered on Recent Trends in Technology, pave the way for ground-breaking achievements.

ABOUT NSCET

Nadar Saraswathi College of Engineering and Technology was established in 2010 to uplift rural students and nurture them with excellence. Located on a 21-acre eco-friendly campus near Theni, the institution focuses on molding outstanding engineers as responsible citizens and professionals.

In today's world, there is a genuine need for an institute that provides quality academic and career education in a personalized atmosphere. NSCET offers programs that prepare students for successful employment through quality teaching, learning, and research. Our goal is to equip students with lifelong knowledge, skills, and credentials for professional advancement at any point in their careers.

Excellence in teaching remains our most important criterion for faculty recruitment. Our faculty are also engaged in continuous research, scholarly work, and service to the region and state. The college offers comprehensive support services to ensure student success.

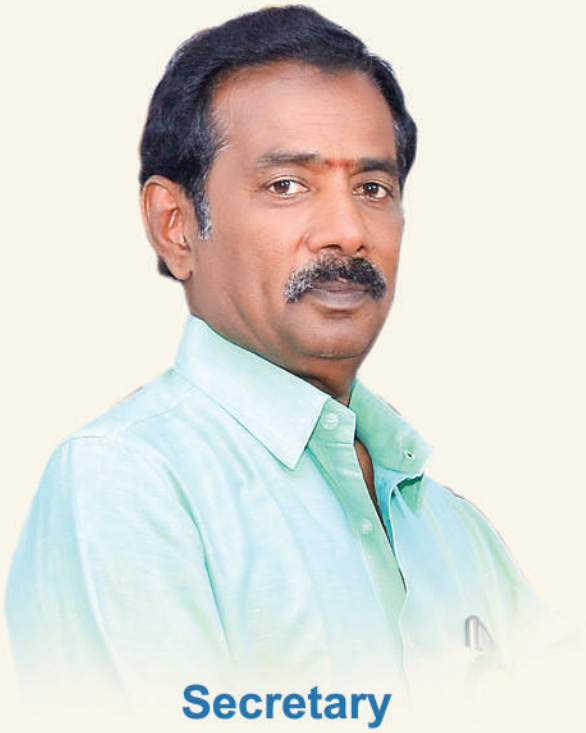
PROMINENT PERSONALITIES OF NSCET

Secretary

Mr. A. Rajkumar, B.B.A.,

I warmly welcome you all to ICRTT-2025. As a representative of student activities, I see this conference as an extraordinary opportunity for students and young researchers to showcase their talents and connect with leading minds. The focus on Recent Trends in Technology will surely inspire students toward new academic and professional horizons.

PROMINENT PERSONALITIES OF NSCET



Secretary

Mr. A.S.R. Maheswaran, B.Sc.,

It gives me great satisfaction to be part of ICRTT-2025, a platform devoted to the academic exploration of technological innovations. Our theme, Recent Trends in Technology, calls for fresh academic insights and critical research contributions. I welcome all delegates and look forward to insightful discussions and findings during the sessions.

PROMINENT PERSONALITIES OF NSCET

Joint Secretary

Er. S. Naveen Ram, B.E., M.B.A.,

It is an honor to serve as the Joint Secretary for ICRTT-2025. This conference embodies our institution's commitment to nurturing a spirit of inquiry and excellence. By exploring Recent Trends in Technology, we hope to inspire new visions for research and development. I congratulate the organizing team for their tireless efforts and wish the participants great success.

PROMINENT PERSONALITIES OF NSCET

Principal

Dr. C. Mathalai Sundaram, M.E., M.B.A., Ph.D., MISTE.,

It is my immense pleasure to welcome all participants, academicians, and industry experts to ICRTT-2025. Our college has always aimed to bridge the gap between theoretical knowledge and practical innovation. The theme, Recent Trends in Technology, is perfectly aligned with this vision. I trust that the deliberations and discussions held here will leave a lasting impact on all of us and contribute meaningfully to the global knowledge pool.

ABOUT THE CHIEF GUEST

Dr. Sidharth Maheshwari, Ph.D.,

Assistant Professor

Department of Computer Science & Engineering

Indian Institute of Technology, Jammu.

Distinguished guests, esteemed faculty, and dear participants,

It is a great honor to deliver the keynote address at ICRTT-2025. The theme Recent Trends in Technology resonates with the transformative era we are living through. Innovation is no longer optional — it is the very engine of progress. This conference provides a platform where brilliant minds meet to challenge ideas and co-create the future. I urge all participants to embrace new paradigms, think beyond boundaries, and contribute meaningfully to the technological revolution.

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Nadar Saraswathi College of Engineering & Technology

INTERNATIONAL CONFERENCE ON RECENT TRENDS IN TECHNOLOGY (ICRTT -25)

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NADAR SARASWATHI COLLEGE OF ENGINEERING & TECHNOLOGY

INTERNATIONAL CONFERENCE ON RECENT TRENDS IN TECHNOLOGY

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BACHELOR OF ENGINEERING -

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

MACHINE LEARNING-DRIVEN TRANSACTIONS FOR E-COMMERCE

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ABSTRACT:

This paper presents a comprehensive investigation into the development of a Machine Learning- based transactional application designed to enhance customer service and operational efficiency, particularly within the e-commerce sector. The primary objective of this research is to leverage machine learning technologies to streamline transactional processes, thereby improving user experience and business operations.

The application exploits advanced algorithms and analytical techniques, including supervised and unsupervised learning methods, to analyze vast amounts of transactional data. These technologies enable real-time insights that facilitate intelligent decision-making, personalized customer experiences, and automated workflows, ultimately leading to increased customer satisfaction and organizational productivity.

Key findings of the research indicate that the implementation of this transactional application can significantly reduce operational costs and response times while optimizing resource allocation. Moreover, the application demonstrates a robust capability of adapting to consumer behavior patterns, which allows businesses to tailor their offerings more effectively and stay competitive in the dynamic e-commerce landscape.

In addition to examining the architectural framework and technological stack employed in the application, this paper addresses several challenges encountered during implementation, such as data privacy concerns and the need for substantial computational resources. By highlighting its transformative impact, the research underscores the potential of machine learning to redefine customer service paradigms and operational strategies across various industries, paving the way for future enhancements and broader applications in the technology sector.

SOFTWARE REUSABILITY AND TESTING USING MACHINE LEARNING

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ABSTRACT:

Software reusability and testing are two critical aspects in modern software development. Reusability increases productivity, reduces costs, and accelerates development, while effective testing ensures software quality and reliability. However, both reusability and testing come with their own challenges. With the increasing complexity of software systems, traditional approaches to reusability and testing often fail to keep up with demands for efficiency and scalability. Recent advancements in Machine Learning (ML) present new opportunities for improving both software reusability and testing practices. This paper explores the application of ML techniques to enhance software reusability, automate testing, and predict potential issues in software systems. The paper outlines key challenges, presents a framework for integrating ML into software engineering practices, and discusses case studies and future research directions. Clustering is a machine learning technique that groups similar data points together. In software testing, clustering can be used to group similar code fragments or test cases that exhibit similar behavior or characteristics. This can help in identifying redundant or overlapping tests, improving test coverage, and optimizing the testing process. Here, I will provide an example of a clustering algorithm applied to software testing using machine learning. We will use K-Means clustering, a popular unsupervised learning algorithm, to group similar code snippets based on their feature representations, such as function names, code structure, or even execution behavior.

KEYWORDS:

Software Reusability, Testing, Machine Learning, Automation, Quality Assurance, Code Quality

AI-ENABLED SMART SAFETY WEARABLE FOR CHILD PROTECTION

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ABSTRACT:

Child safety, especially for children with disabilities, requires advanced monitoring and rapid emergency response solutions. This paper introduces an AIdriven wearable safety system that provides real-time protection through fall detection, gesture-based SOS activation, unknown person recognition, emotion detection, and two-way emergency communication. The device incorporates an MPU6050 inertial measurement unit (IMU) for motion tracking and fall detection, an ESP32-CAM for facial recognition and emotion analysis, and IMU-based gesture recognition for intuitive, hands-free SOS triggering. Key functionalities include haptic feedback for discreet alerts, live video streaming for real-time oversight, and GPS tracking for accurate location identification. A GSM module ensures instant alert transmission, enabling automated SOS messages, live location updates, and two-way voice communication with parents or emergency services. The system utilizes multi-sensor data fusion and AI-powered anomaly detection to differentiate emergencies from everyday activities, significantly reducing false alarms. By integrating machine learning-based safety mechanisms, intelligent communication protocols, and continuous monitoring, this wearable technology delivers a proactive and dependable child safety solution, ensuring constant protection, swift intervention, and enhanced parental awareness in critical scenarios.

KEYWORDS:

Child Safety Wearable, AI-Powered Fall Detection, Gesture-Controlled SOS, Real-Time Threat Recognition, Adaptive Emergency Communication.

SMART SHOPPING TROLLEY SYSTEM USING AI

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ABSTRACT:

This project introduces an Assistive Barcode and QR Code Scanning System tailored for visually impaired individuals. Its primary goal is to help users identify products through voice feedback. The system uses a webcam to capture live video, from which it scans for barcodes or QR codes using computer vision. OpenCV handles image processing, while Pyzbar detects and decodes the codes. Once decoded, the system searches for the corresponding product information in a predefined local database, such as a CSV or JSON file. This eliminates the need for internet access, making the solution fully offline and reliable. The retrieved information is then converted to speech using the Pyttsx3 text-to-speech engine. This allows users to hear product names or details instantly. The process is seamless: users simply present a product to the webcam, and the system identifies and speaks its details automatically. Python is used for implementation due to its strong support for libraries in vision, audio, and data handling. The system is modular, enabling easy updates to the database or codebase. It can be used in homes, stores, or care facilities to support independent living. By combining low-cost hardware and open-source software, the project is both affordable and scalable. It showcases how accessible technology can empower people with visual impairments, improving their daily interactions and boosting their confidence.

KEYWORDS:

Accessibility ,Visually Impaired, Barcode/QR Code, Computer Vision,OpenCv pyzbar, Text-to-Speech (TTS)

Pothole Detection Techniques Using Deep Learning and YOLO Variants

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ABSTRACT:

Detecting potholes is a crucial aspect of road maintenance and transportation safety. Damaged roads can lead to vehicle wear, accidents, and significant economic losses. Traditional methods such as manual inspections or sensor-based systems are often slow, expensive, and lack accuracy. With the advancements in deep learning and computer vision, automated pothole detection has become a practical and efficient alternative. This survey explores the application of deep learning—particularly the YOLO (You Only Look Once) family of models—for pothole detection. It reviews and compares different YOLO versions based on their accuracy, processing speed, and suitability for real-time deployment. Additionally, it analyzes existing research studies that utilize these models, highlighting their advantages and limitations. The paper also discusses the integration of GPS-based reporting and how connecting detection systems with road maintenance workflows can enhance pothole management. Finally, it outlines future directions for improving the performance, scalability, and adoption of such systems.

KEYWORDS:

Pothole detection, YOLO, Deep Learning, Road Safety, Image Processing.

VOICE BIOMETRIC BASED SECURITY AUTHENTICATION SYSTEM

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ABSTRACT:

In recent years, the rise of deepfake technologies and AI-generated voices has posed serious challenges to traditional voice authentication systems. To address this emerging threat, this project proposes a Voice Biometrics Authentication System with Deepfake Detection, combining robust speaker verification and spoof detection techniques. The system utilizes ECAPA-TDNN to extract unique speaker embeddings for identity verification and AASIST to detect synthetic or spoofed voice inputs. During registration, users record voice samples that are processed into secure voiceprints. During authentication, the user's live voice is compared with the stored voiceprints and simultaneously verified for authenticity, ensuring both identity and genuineness. The complete implementation enables real-time voice capture, processing, and feedback without requiring an internet connection. By integrating biometric authentication with deepfake resilience, the system offers a highly secure and scalable solution applicable to domains such as banking, smart devices, healthcare, and government services. Overall, this project demonstrates that voice, when combined with modern deep learning techniques, can serve as a powerful, secure, and future-ready biometric for real-world authentication.

KEYWORDS:

Voice Biometrics, Speaker Verification, Deepfake Detection, ECAPA-TDNN, AASIST, Anti-Spoofing, Neural Networks, Voice Authentication, Audio Spoofing, Synthetic Voice Detection, Biometric Security, Real-Time Authentication, AI-based Authentication

AUTO-BLURRING TECHNOLOGY IN CAMERA BY USING AI&ML

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ABSTRACT:

This paper introduces a novel AI-powered solution for real-time nudity detection in mobile camera systems. Designed to operate offline and ensure user privacy, the proposed system integrates machine learning algorithms with optimized mobile frameworks to blur or blackout inappropriate content in real-time. Leveraging TensorFlow Lite and OpenCV, the solution achieves high accuracy while maintaining efficiency on resource-constrained devices. This approach has potential applications in enhancing personal safety, privacy,and ethical standards in mobile photography.

KEYWORDS:

Machine Learning

DESKTOP VOICE ASSISTANCE

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ABSTRACT:

In the modern digital era, human-machine interaction is rapidly evolving, with voice-based interfaces gaining popularity. This project focuses on the design and development of a Desktop Voice Assistant, an intelligent system capable of understanding, processing, and responding to user voice commands. The assistant listens to the user's speech, converts it into text, and processes the text to recognize and identify valid commands. Once a command is recognized, the system executes the relevant task and provides an appropriate response. If the command is unrecognized, it prompts the user for clarification. The assistant then converts the textual response into speech, offering a smooth and interactive user experience. This system integrates technologies such as speech recognition, natural language processing (NLP), and text-to-speech (TTS) to enable efficient interaction. It can perform various functions like opening applications, sending emails, searching information online, and translating languages using simple voice inputs, reducing manual effort and enabling hands-free operation. By implementing a real-time voice-controlled interface, the project contributes to the field of human-computer interaction (HCI) and sets the stage for future enhancements such as multilingual support, contextual understanding, and integration with smart devices. The developed assistant highlights the potential of voice technology in building intelligent, user-centric digital environments

KEYWORDS:

Voice Assistant, Speech Recognition, Natural Language Processing (NLP), Text-to-Speech (TTS), Artificial Intelligence (AI), Voice User Interface (VUI).

EASYWEB – LIGHTWEIGHT PROGRAMMING LANGUAGE

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ABSTRACT:

Web development traditionally demands mastery over HTML, CSS, and JavaScript, creating a steep learning curve for beginners. To address this, we propose EasyWeb IDE, an innovative, beginner-friendly Integrated Development Environment that simplifies web development through a custom Domain-Specific Language (DSL). EasyWeb enables users to build fully functional web pages within a single file, eliminating the need to switch between multiple coding languages or manage complex file structures. The system employs a Lexer–Parser–Generator pipeline to transform simplified user inputs into structured HTML, CSS, and JavaScript code. Key features include real-time preview, error detection with user-friendly feedback, and single-click export functionality. Designed with educational and accessibility goals in mind, EasyWeb democratizes web development by lowering technical barriers and offering an intuitive platform for students, hobbyists, and non-technical users. Benchmark results demonstrate a significant reduction in development time, enhanced code readability, and improved user engagement. The project sets a foundation for future enhancements such as backend integration, cloud-based collaboration, mobile app export capabilities, and AI-assisted coding, making EasyWeb a versatile tool for the next generation of web creators.

KEYWORDS:

EasyWeb, Integrated Development Environment (IDE), Domain-Specific Language (DSL), Web Development, Real-time Preview, Lexer–Parser–Generator

IMAGE MODIFICATION AND EDIT DETECTION

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ABSTRACT:

The rapid proliferation of digital media and sophisticated image editing tools has made image forgery detection a critical task in maintaining the credibility of visual content. This paper presents a Python-based web application designed to detect image modifications using a hybrid model that combines deep learning techniques with metadata analysis. A pre-trained Convolutional Neural Network (CNN) is utilized to classify images as authentic or tampered based on visual features, while the piexif library is used to extract and analyze EXIF metadata for inconsistencies that may indicate tampering. The system also includes source detection logic to infer the platform of origin, such as WhatsApp or Facebook, and integrates Google's reverse image search to check if the uploaded image has been previously used online, further supporting verification. Experimental results demonstrate that the model performs effectively in identifying common forgery techniques such as splicing and copy-move, with high precision and recall. The solution is scalable, user-friendly, and automated, offering practical applications in areas like digital forensics, journalism, and fake news detection.

KEYWORDS:

Image Forgery Detection, Deep Learning, EXIF Metadata, Convolutional Neural Network (CNN), Image Tampering, Digital Forensics, Reverse Image Search, Image Source Identification, Web Application, Fake Media Detection.

FACIAL COMPOSITE GENERATION AND IDENTIFICATION IN FORENSIC INVESTIGATIONS

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ABSTRACT:

In forensic science, creating hand-drawn face sketches for criminal recognition and identification is often a limited and time-consuming process when integrated with modern technologies. To address this, we introduce a standalone application designed to enable users to construct composite face sketches of suspects independently, without the need for forensic artists, by utilizing a drag-and-drop feature. This application further aims to automatically match the generated composite sketches with police databases much more rapidly and efficiently through the application of deep learning methodologies and cloud infrastructure.

KEYWORDS:

Forensic Face Sketch, Face Sketch Construction, Face Recognition, Criminal Identification, Deep Learning, Machine Locking, Two Step Verification.

FIRST STEP LEARNING PLATFORM

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ABSTRACT:

In today's digital age, the demand for accessible, personalized, and interactive educational tools has significantly increased. The Learning Platform is an innovative web-based solution designed to enhance the online learning experience by integrating modern technologies and adaptive learning strategies. Aimed at catering to diverse learner needs, the platform offers a modular structure of courses, personalized learning paths, real-time performance tracking, and intelligent recommendations. It incorporates features such as video lectures, quizzes, interactive simulations, discussion forums, and progress analytics. Additionally, it supports teacher dashboards for content management and student monitoring, ensuring a seamless experience for both educators and learners. A key highlight of the platform is its adaptability — the system adjusts content difficulty and presentation style based on user interaction and performance, fostering a more engaging and effective learning environment. Developed using modern web technologies and scalable backend architecture, the Learning Platform ensures reliability, usability, and accessibility across devices. This project addresses the gaps in traditional e-learning systems by promoting user engagement, personalized content delivery, and continuous assessment, thereby contributing to a more inclusive and efficient digital education ecosystem.

KEYWORDS:

E-learning, Adaptive Learning Modular Education, Online Learning Platform, Personalized Learning, Learning Management System (LMS), Educational Technology, Interactive Learning, Student Performance Tracking, Digital Education.

SUGARCANE DISEASES PREDICTION AND TREATMENT SYSTEM

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ABSTRACT:

Sugarcane disease poses a significant challenge to the sugar industry in India, often resulting in substantial crop damage and financial losses. Early detection and treatment of these diseases are crucial, but many farmers lack the necessary expertise to identify them. This study explores the application of machine learning, specifically image processing and deep learning techniques (CNN), as a potential solution to this issue. By training a deep learning model on a dataset of disease-infected sugarcane images, the research successfully develops a model capable of detecting and classifying various sugarcane diseases. This approach provides a promising method to assist farmers in identifying and classifying sugarcane diseases using deep learning algorithms. Moreover, the model's potential for real-time implementation through mobile applications or drone-based monitoring systems offers a scalable and accessible solution for disease detection in the field. This technology contributes to more efficient crop management and higher agricultural productivity. Additionally, by accurately identifying specific diseases, this approach can help reduce pesticide misuse, enabling farmers to apply targeted treatments and promoting more environmentally sustainable farming practices.

KEYWORDS:

Deep learning, Convolutional Neural Network (CNN), Image processing, Machine learning, Disease detection, Crop management, Precision agriculture, Real-time monitoring, Mobile applications, Drone-based systems, Pesticide reduction, Sustainable farming, Agricultural productivity.

DSAS: A SECURE DATA SHARING AND AUTHORIZED SEARCHABLE FRAMEWORK FOR E-HEALTHCARE SYSTEM

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ABSTRACT:

In the e-healthcare system, an increasing number of patients are able to enjoy high-quality medical services by sharing encrypted personal healthcare records (PHRs) with doctors or medical research institutions. However, one of the major challenges is that encrypted PHRs prevent effective information retrieval, resulting in a decrease in data utilization. Another challenge is that the medical treatment process often requires doctors to be online at all times, which may not be feasible for all doctors, especially when they are absent under certain circumstances. In this paper, we propose a new secure and practical proxy searchable re-encryption scheme, which allows medical service providers to efficiently and safely monitor and research PHRs remotely. Through our scheme, DSAS, (1) patients' healthcare records are encrypted before being uploaded to a cloud server, ensuring the privacy and confidentiality of PHRs; (2) only authorized doctors or research institutions have access to the PHRs; (3) the doctor-in-charge, Vinay, can delegate medical research and utilization tasks to Rajan or a specific research institution via the cloud server, minimizing information exposure to the cloud server. We formalize the security definitions and prove the security of our scheme. Finally, performance evaluations demonstrate the efficiency of our approach.

KEYWORDS:

e-Healthcare System, Personal Healthcare Records (PHRs), Encrypted Data Sharing, Proxy Searchable Re-Encryption, Secure Data Retrieval.

A SUPERVISED LEARNING FRAMEWORK FOR PREDICTING GSC ANTIBODY SEROPOSITIVITY IN GUILLAIN–BARRÉ SYNDROME USING MULTIVARIATE CLINICAL AND DEMOGRAPHIC INDICATORS

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ABSTRACT:

This paper proposes a robust supervised learning framework for predicting ganglioside complex (GSC) antibody seropositivity in patients with Guillain–Barré Syndrome (GBS) using multivariate clinical and demographic features. Based on a comprehensive dataset of 129 GBS patients, advanced machine learning methods such as support vector machines, random forests, decision trees, and k-nearest neighbors were employed to predict seropositivity for six key anti-ganglioside antibodies (GM1, GM2, GD1a, GD1b, GT1b, GQ1b). To ensure robustness, rigorous feature selection, cross-validation, and class imbalance handling were implemented. The results demonstrate that routine clinical data can provide accurate predictions of antibody seropositivity, supporting the management of GBS in situations where serological assays are delayed or unavailable.

KEYWORDS:

Guillain–Barré Syndrome, antibody prediction, supervised learning, machine learning, ganglioside, seropositivity, clinical data, feature selection.

SURVEY ON EFFICIENT AUTOMATED NUMBER PLATE RECOGNITION SYSTEM USING YOLOV8 AND PADDLE OCR

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ABSTRACT:

Automatic Number Plate Recognition (ANPR) is an essential technology widely used in applications such as traffic monitoring, toll collection, parking management, and law enforcement. Traditional ANPR systems typically utilize Optical Character Recognition (OCR) frameworks like Easy OCR; however, they often struggle with accuracy due to challenges posed by varying lighting conditions, skewed license plates, and diverse language scripts. The proposed research aims to overcome these limitations by integrating YOLOv8 with Paddle OCR, thereby enhancing the robustness, accuracy, and multilingual capabilities of ANPR systems. This survey delves into various methodologies adopted in ANPR, reviews existing literature, identifies prevailing challenges, and examines the role of advanced AI models in significantly improving license plate recognition.

KEYWORDS:

ANPR, YOLOv8, Paddle OCR, license plate recognition, OCR, AI models.

FLOODSCOUT: MACHINE LEARNING AND REAL-TIME GEOSPATIAL INTELLIGENCE FOR FLOOD HOTSPOT PREDICTION AND DISASTER RESILIENCE

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ABSTRACT:

Flooding presents a significant global threat, exacerbated by climate change and increasing urbanization. Traditional flood prediction methods often struggle with complexity, high data dependency, and computational intensity. This paper introduces a web-based application that utilizes machine learning (ML) to offer user-friendly and adaptable flood-risk predictions. The platform enables users to upload their own datasets, which are then processed to train ML models such as Random Forest (RF) and Multi-Layer Perceptron (MLP). The system provides interactive visualizations and downloadable reports to improve the accessibility and interpretability of flood-risk information. Compared to conventional approaches, this solution offers greater accuracy, flexibility, and ease of use, thereby empowering communities and decision-makers to proactively prepare for and mitigate flood events.

KEYWORDS:

Flood Prediction, Machine Learning, Web Application, Random Forest, Multi-Layer Perceptron, Data Visualization, Disaster Management.

SPOILED FOOD DETECTION AND REMOVAL

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ABSTRACT:

Food spoilage poses a significant challenge to food safety, public health, and waste reduction, affecting both consumers and the food industry while leading to economic losses and environmental concerns. To address this, researchers have developed an innovative prototype that leverages technology to tackle spoilage factors such as precipitation, humidity, and temperature, ultimately extending the shelf life of perishable items. The prototype integrates precise identification techniques for various fruits and vegetables, enabling accurate assessment of their freshness. Equipped with sensors and actuators, the system continuously monitors gas emissions, humidity levels, and temperature variations within the refrigerator. This real-time monitoring facilitates proactive intervention to prevent spoilage, with users receiving timely alerts via mobile messages about the freshness of their food items. Early and accurate detection is essential to prevent the consumption of harmful products and reduce unnecessary waste. The system distinguishes between fresh and spoiled food using gas sensors and flags spoiled items for removal or automatically separates them in an automated IoT-based system. Designed to enhance food quality control across domestic, retail, and industrial settings, the method improves consumer safety and reduces food loss. Future advancements may include enhanced real-time monitoring capabilities. The success of the prototype lies in its ability to monitor and control key environmental factors that influence food freshness. By accurately identifying spoilage risks and notifying users in real-time, it empowers informed decision-making and waste reduction. Additionally, user interaction ensures timely human oversight in spoilage management, maintaining food quality. The inclusion of robotic arms for automated disposal further minimizes the environmental footprint, contributing to a more sustainable food ecosystem.

REAL TIME FLOOD FORECASTING USING MACHINE LEARNING

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ABSTRACT:

Floods are among the most frequent and destructive natural disasters, especially in regions with high rainfall and vulnerable infrastructure, such as many parts of India. Traditional flood prediction systems often suffer from limitations in accuracy, responsiveness, and data integration. This study presents a real-time flood forecasting model using machine learning techniques that address these challenges by leveraging both spatial and temporal data. The proposed system integrates satellite imagery, rainfall data, soil moisture, river flow rates, and topographical features to detect patterns that signal impending flood events. Convolutional Neural Networks (CNNs) are employed to extract spatial features from geospatial data, while Recurrent Neural Networks (RNNs), particularly Long Short-Term Memory (LSTM) networks, model temporal sequences in environmental conditions. Unlike conventional hydrological models, this hybrid approach enables the system to learn complex relationships and provide accurate predictions with minimal delay. The model is continuously updated with real-time data to improve its performance over time. Validation using historical datasets from flood-prone regions in India demonstrates a significant improvement in prediction accuracy and early warning capability. This research aims to enhance disaster preparedness by providing timely alerts to authorities and communities, ultimately reducing the human and economic toll of flood events.

KEYWORDS:

Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), Long Short-Term Memory (LSTM), hybrid approach, hydrological models

ADAPTIVE DISTRIBUTED FUZZY LOGIC ROUTING FOR ENERGY OPTIMIZATION AND UNCERTAINTY MANAGEMENT IN WIRELESS SENSOR AND MOBILE AD-HOC NETWORKS

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ABSTRACT:

In heterogeneous and dynamic wireless sensor networks (WSNs) and mobile ad-hoc networks (MANETs), optimizing energy consumption while maintaining robustness against environmental and topological uncertainties remains a critical challenge. In this paper, we propose an Adaptive Distributed Fuzzy Logic Routing (ADFLR) system that simultaneously addresses energy efficiency, load balancing, and uncertainty management. Our approach integrates dynamic fuzzy logic controllers that adaptively tune membership functions based on real-time network conditions and environmental factors. ADFLR incorporates fuzzy interval analysis to model spatial, temporal, and environmental uncertainties, ensuring stable routing cost estimation under varying conditions. The system constructs fuzzy minimum spanning trees dynamically for both unicast and multicast communication, balancing energy consumption and minimizing routing errors. Extensive simulations demonstrate that ADFLR outperforms existing solutions such as DEFL, MTE, and FMST in terms of network lifetime, energy balancing, and resilience to environmental disruptions, achieving near-optimal performance across diverse traffic and mobility scenarios.

KEYWORDS:

Mobile Ad-hoc Networks (MANETs), Energy-efficient Routing, Fuzzy Logic, Distributed Routing, Load Balancing, Uncertainty Management

HYBRID MACHINE LEARNING TECHNIQUES FOR SMART ENERGY FORECASTING AND OPTIMIZATION

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ABSTRACT:

Optimizing energy management has become a critical research topic due to the increasing global demand for energy and growing concerns about environmental sustainability. Recent advancements in digital technology and artificial intelligence (AI) have significantly transformed energy management systems, enhancing sustainability, reliability, and efficiency. This survey provides a comprehensive analysis of strategies for energy acquisition, management, and consumption optimization, focusing on AI-driven approaches such as digital twin technology, machine learning, deep learning, and fuzzy logic. It examines their applications in various energy management fields, including smart grids, smart homes, and property management systems. The paper highlights key approaches, evaluates their effectiveness, and discusses the challenges and limitations associated with their implementation. By synthesizing findings from various studies, this research aims to guide future work and real-world applications in the optimization of sustainable energy systems.

KEYWORDS:

Energy management, Artificial Intelligence, Smart Grid, Digital Twin, Machine Learning, Optimization, Sustainability.

GESTURE-BASED TOOL FOR STERILE BROWSING USING RADIOLOGY IMAGES

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ABSTRACT:

In modern medical environments, maintaining sterility while interacting with radiological imaging systems is critical. To address this, the proposed project initially aimed to develop a Gesture-Based Tool for Sterile Browsing Using Radiology Images, enabling medical practitioners to interact with patient scans without physical contact. The system was designed to use hand gestures for image navigation, zooming, and selection. While the initial implementation achieved basic gesture capture and frame analysis, real-time, advanced radiology image processing presented both hardware and software limitations.

To continue the project effectively, we extended the solution by integrating a Hand Gesture Recognition System powered by Google's MediaPipe framework. This system detects hand landmarks from a webcam feed, preprocesses gesture data, and classifies both static and dynamic gestures using Multi-Layer Perceptron (MLP) classifiers. The recognized gestures are then used for performing basic image operations, demonstrating the concept of sterile, contactless interaction.

This hybrid approach preserves the core aim of touchless operation while adapting to practical development constraints, resulting in a functional prototype that addresses real-world needs in clinical settings.

A MACHINE LEARNING-DRIVEN FRAMEWORK FOR DOS ATTACK DETECTION IN CLUSTER-BASED WIRELESS SENSOR NETWORKS

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ABSTRACT:

Wireless Sensor Networks (WSNs) are the backbone of smart infrastructure, but they face a serious challenge – Denial-of-Service (DoS) attacks, which can disrupt services and drain node energy, making the system vulnerable. Existing methods are either too computation-heavy or too slow for real-time detection. Our lightweight, machine learning-based framework addresses this by combining Fuzzy C-Means (FCM) clustering for efficient data grouping, Principal Component Analysis (PCA) for dimensionality reduction, and Random Forest for precise classification, specifically for detecting Grayhole and Blackhole attacks in real-time using simulated WSN data. To simplify the process, we developed a Flask-based web application for visual monitoring and instant alert generation. The results show better detection accuracy, faster response times, and significant energy savings compared to traditional methods, making this framework a step toward more resilient and sustainable WSN deployments.

KEYWORDS:

Wireless Sensor Networks, Denial-of-Service Attack, Fuzzy C-Means, Principal Component Analysis, Random Forest.

MACHINE LEARNING-BASED STRATEGY FOR EFFICIENT NODE LOCALIZATION IN WIRELESS SENSOR NETWORKS

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ABSTRACT:

Node localization is a fundamental challenge in Wireless Sensor Networks (WSNs) as precise location estimation is essential for various applications. Traditional localization techniques, including bio-inspired and mathematical models, often struggle with high computational complexity and limited adaptability to diverse environments. Recent advancements in Machine Learning (ML) offer promising solutions by leveraging data-driven approaches to optimize localization accuracy. This survey explores existing localization methods in WSNs, categorizing them into range-based and range-free techniques. Furthermore, it examines the application of ML models such as Support Vector Regression (SVR), Random Forest Regression (RFR), and CatBoost Regression (CAT) in reducing Average Localization Error (ALE). Additionally, optimization strategies, including the Giant Trevally Optimizer (GTO), are evaluated for their role in enhancing prediction accuracy and reducing computational time. A comparative analysis of conventional and ML-driven localization methods is conducted to highlight their strengths, limitations, and potential improvements. Finally, this paper discusses emerging trends, challenges, and future research directions in ML-based localization for WSNs.

ENHANCING PRECISION AGRICULTURE WITH AI, IOT, AND EDGE COMPUTING FOR REAL-TIME DECISION SUPPORT

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ABSTRACT:

Effectively feeding a burgeoning world population is one of the main goals of sustainable agricultural practices. The integration of AI, IoT, and edge computing technologies in agriculture presents a promising solution to improve productivity, optimize resource usage, and achieve sustainable farming. This paper proposes a hybrid system leveraging AI models, IoT devices, and edge computing to address key challenges such as latency and real-time decision-making in precision agriculture. By deploying lightweight AI models on edge devices, the approach reduces data processing delays, enhances resource management, and improves crop yield predictions. The system's effectiveness is analyzed based on a combination of historical and synthetic datasets, providing a roadmap for sustainable, adaptable, and efficient precision farming.

KEYWORDS:

Precision Agriculture, AI, IoT, Edge Computing, Real-time Decision Support, Resource Optimization, Crop Yield Prediction.

INTELLIGENT DOCUMENT PARSING AND CALCULATION SYSTEM USING ARTIFICIAL VISION

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ABSTRACT:

Detecting impurities is crucial for producing high-quality paper, as issues like specks, tears, and discoloration can significantly affect both usability and value. This research introduces an advanced artificial vision system that integrates real-time imaging with predictive analytics to detect and forecast impurity occurrences. Utilizing convolutional neural networks (CNNs), the system accurately identifies defects and employs predictive defect mapping to highlight areas likely to contain impurities, thereby enhancing production efficiency. Testing demonstrates a detection accuracy exceeding 97%, and the system's predictive capabilities contribute to reducing waste and minimizing downtime. Scalable and adaptable, the solution integrates seamlessly into existing workflows, offering a transformative approach to quality control while promoting sustainable manufacturing practices.

KEYWORDS:

artificial vision, impurity detection, predictive analytics, paper industry, machine learning, quality assurance.

REAL-TIME SIGN LANGUAGE RECOGNITION AND TEXT CONVERSION USING LSTM FOR ENHANCED COMMUNICATION ACCESSIBILITY

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ABSTRACT:

Sign language recognition has gained significant attention in recent years as an essential tool for bridging the communication gap between individuals with hearing impairments and the broader society. Traditional approaches relying on Convolutional Neural Networks (CNNs) have shown promise in recognizing static hand gestures, but they struggle with sequential and dynamic sign language interpretation. This survey paper explores recent advancements in Long Short-Term Memory (LSTM)-based deep learning models, which excel at temporal sequence processing, making them more suitable for real-time sign language recognition and text conversion. The paper reviews state-of-the-art methodologies used in sign language translation, focusing on the effectiveness of LSTM networks in capturing gesture sequences. A comparative analysis is conducted on existing datasets, including Indian Sign Language (ISL), American Sign Language (ASL), and Bengali Sign Language (BdSL), highlighting their limitations and applicability to deep learning models. Furthermore, key challenges such as gesture complexity, real-time processing constraints, dataset availability, and multilingual sign recognition are discussed. This survey aims to provide a comprehensive evaluation of existing research, offering insights into hybrid deep learning models, transformer-based approaches, and multimodal recognition techniques as potential solutions for improving accuracy and efficiency in AI-driven sign language translation systems. By addressing these challenges, the study seeks to guide future research in developing scalable, real-time, and accessible sign language recognition technologies.

KEYWORDS:

Real-Time Sign Language Recognition, LSTM-Based Gesture Recognition, Sign Language to Text Conversion, Deep Learning for Sign Language, Sequential Gesture Processing.

SAFEGUARD NET: ENHANCING CORPORATE SAFETY VIA TAILORED DEEP TRANSFER LEARNING FOR THREAT RECOGNITION

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ABSTRACT:

In today's rapidly evolving corporate environments, ensuring comprehensive security measures is paramount. This paper presents *Safeguard Net*, a deep transfer learning-based model designed to enhance corporate safety through effective multiclass threat detection. Recognizing the limitations of existing binary threat detection systems, our approach introduces a diverse dataset encompassing a wide array of threat categories, including knives, guns, fires, and normal scenarios. Utilizing the Xception architecture, *Safeguard Net* achieves an overall accuracy of 94.5%, precision of 92.3%, recall of 93.8%, and an F1 score of 93.0%. The integration of a varied dataset enhances performance by providing a comprehensive range of scenarios for training. This model provides a robust and accurate solution for corporate security needs.

KEYWORDS:

Corporate Safety, Deep Transfer Learning, Threat Detection, Xception Model, Multiclass Classification.

EARLY DIABETES PREDICTION USING AI MODELS AND EHR DATA

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ABSTRACT:

Diabetes is a chronic disease affecting millions worldwide, leading to severe complications if not detected early. Early prediction enables timely medical intervention and lifestyle changes, reducing health risks. Machine learning (ML) techniques have proven effective in predicting diabetes using clinical and lifestyle-related data. Among them, the Light Gradient Boosting Machine (LightGBM) is highly efficient in handling large datasets, offering faster training speed and improved accuracy. Compared to traditional models like logistic regression and decision trees, LightGBM excels in feature selection, reduces overfitting, and enhances predictive performance. This survey explores various ML techniques for early diabetes prediction, focusing on LightGBM's advantages. The integration of ML in healthcare can improve early diagnosis, optimize treatment plans, and enhance patient outcomes, making LightGBM a valuable tool in diabetes management.

KEYWORDS:

Diabetes prediction, Machine Learning, LightGBM, Electronic Health Records (EHR), AI in healthcare.

GENERATIVE AI FOR JURISPRUDENTIAL ANALYSIS: AUTOMATED LEGAL REASONING AND SCENARIO-SPECIFIC GUIDANCE IN INDIAN LAW WITH A GPT AND LAWBERT HYBRID MODEL

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ABSTRACT:

The Indian legal system, rich with diverse law, acts, and judgments, poses a significant challenge for efficient legal research and document drafting. This project proposes a hybrid AI-based legal research system that integrates LawBERT for legal document retrieval and GPT-based/Gemma models for intelligent legal text generation. Through an extensive data pre-processing phase involving web scraping, OCR extraction, named entity recognition (NER), and semantic text similarity (STS) analysis, the system ensures high-quality legal data handling. Fine-tuning is performed on Indian-specific legal datasets like InLegalBERT and NyayaAnumana to enhance domain adaptation. Techniques such as Retrieval-Augmented Generation (RAG), model optimization via ONNX, and explainable AI methods like SHAP and LIME are incorporated to build a transparent, fast, and trustworthy system. The proposed system aims to assist legal professionals, students, and citizens by automating case law retrieval, contract drafting, risk prediction, and providing scenario-based legal assistance. Evaluation of Indian legal benchmarks ensures that the solution is effective, accurate, and suitable for real-world legal applications.

KEYWORDS:

Legal Research, LawBERT, GPT / Gemma, Legal Text Generation, NER, STS, RAG, InLegalBERT, OCR, XAI, SHAP, LIME, ONNX Optimization.

REAL-TIME DRIVER DEPRESSION MONITORING FOR ACCIDENT PREVENTION IN SMART VEHICLES

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ABSTRACT:

The increase in road accidents due to impaired driver behavior requires real-time monitoring solutions. This study presents a system for detecting transfer-based depression using VGG-16 for facial expression recognition in smart vehicles. The system captures real-time video through dashboard cameras, analyzes the emotional state of the driver, and automatically transfers control to the autonomous system of the vehicle when depression is detected. Experimental results show 96% accuracy, surpassing traditional models such as ResNet50. The proposed system enhances driver safety, reduces the risk of accidents, and integrates deep learning with vehicle automation for intelligent transport solutions. This study examines the implications of automated intervention in reducing human error to ensure road safety. By leveraging a strong deep learning structure, the system effectively reduces risks associated with depression-induced impaired driving. Future developments may involve integrating additional physical indicators for increased accuracy and reliability.

PLANT DISEASE DETECTION USING DEEP LEARNING

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ABSTRACT:

Plant diseases pose a significant threat to agricultural productivity in Tamil Nadu, particularly for staple crops such as rice, cotton, banana, tomato, and groundnut. Traditional methods of disease identification often rely on expert knowledge, which is not always accessible to rural farmers. This project proposes a deep learning-based approach to automate plant disease detection using leaf images, enabling early diagnosis and timely intervention. A Convolutional Neural Network (CNN) model is trained on a dataset of healthy and diseased plant leaves and integrated into a user-friendly Flask-based web application. Farmers can upload leaf images via mobile or desktop devices to receive instant predictions on plant health, reducing dependency on chemical overuse and improving crop management practices.

The system emphasizes accessibility, scalability, and cost-effectiveness, empowering farmers with limited technical expertise to adopt sustainable agricultural practices. Ethical considerations, including data privacy for user-submitted images and model accuracy validation, are addressed to ensure reliability and trust. Experimental results demonstrate high diagnostic accuracy, highlighting the potential of AI to transform agricultural outcomes in both rural and urban regions of Tamil Nadu. Future enhancements may involve expanding the dataset to include regional pest-specific diseases, integrating real-time mobile app features, and leveraging IoT sensors for continuous field monitoring.

KEYWORDS:

Deep Learning, Convolutional Neural Network (CNN), Plant Disease Detection, Precision Agriculture, Sustainable Farming, Web Application.

EARLY-STAGE ORAL CANCER IDENTIFICATION USING WHITE LIGHT IMAGING AND LIGHTGBM ALGORITHM

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ABSTRACT:

Oral cancer is a significant public health concern globally, with early detection playing a crucial role in improving patient outcomes. In this project, we propose a novel approach for oral cancer detection by leveraging deep learning techniques. The system is developed using Python as the primary coding language, with Flask serving as the web framework and HTML, CSS, and JavaScript for the frontend interface. The dataset used in this project consists of 1013 oral cancer images and 294 non-cancerous oral images, which are meticulously labeled for easy classification. This dataset serves as a comprehensive resource for researchers and developers in the field of oral cancer detection using machine learning algorithms. With a balanced representation of cancerous and non-cancerous samples, the dataset facilitates the exploration of innovative approaches to enhance diagnostic accuracy. The proposed model employs the LightGBM algorithm to efficiently classify oral cancer stages based on white light images, ensuring a robust and accurate detection system.

KEYWORDS:

Oral cancer detection, Python-based system, medical image classification, cancerous vs. non-cancerous samples, LightGBM algorithm, feature extraction and classification.

SENTRY CONNECT (SMART EARLY NOTIFICATION AND TRACKING RESPONSE SYSTEM): AN AI-POWERED EARLY WARNING AND ALERT SYSTEM FOR TERROR PREVENTION IN CONFLICT-PRONE ZONES (WITH REFERENCE TO THE PAHALGAM ATTACK)

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ABSTRACT:

The recent terror attack in Pahalgam, Jammu & Kashmir, has brought to light the severe gaps in early detection and response to acts of terrorism. Delays in identifying threats often lead to irreversible loss of life and infrastructure. To address this, we propose **SENTRY CONNECT**, an AI-powered, real-time alert and response system specifically designed to detect and prevent terror attacks before they occur. The system integrates machine learning, smart IoT surveillance, and a secure mobile alert app. AI models predict threats based on historical and real-time data, while IoT devices and cameras detect anomalies such as weapon activity, abandoned objects, or suspicious movement. Civilians can report incidents via the app, which instantly notifies nearby police and army personnel. A centralized dashboard supports real-time threat tracking and decision-making by authorities. This solution not only bridges the communication gap between civilians, police, and military but also empowers all parties with faster, data-driven decision-making. By focusing on early detection, the system provides a preventive framework to avoid tragedies like the Pahalgam attack and can be extended to other conflict-prone areas.

KEYWORDS:

Terrorism, AI Surveillance, Early Threat Detection, IoT Security, Pahalgam Attack, Smart Policing, Public Safety

AI-POWERED VISION: A DEEP LEARNING-BASED SYSTEM FOR EARLY DETECTION OF DIABETIC EYE DISEASES

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ABSTRACT:

Diabetic eye diseases, such as diabetic retinopathy, macular edema, cataracts, and glaucoma, are leading causes of vision impairment worldwide. Early and precise detection is essential to prevent severe complications and enable timely medical intervention. This study presents *Deep Diabetic*, an AI-driven identification system that utilizes convolutional neural networks (CNNs) combined with transfer learning and attention mechanisms to autonomously analyze retinal fundus images for diabetic identification of ocular diseases. The framework integrates advanced image-processing techniques and deep learning algorithms, including ResNet, EfficientNet, and Vision Transformers, to improve feature extraction, classification accuracy, and model interpretability. Trained on diverse publicly available ophthalmic image datasets, *Deep Diabetic* outperforms conventional machine learning models, achieving high precision, recall, and robustness. The system offers a scalable, cost-efficient, and clinically adaptable solution, seamlessly integrating into ophthalmic workflows to support healthcare professionals in early disease diagnosis. This research harnesses advanced deep neural networks and AI-powered feature refinement to enhance ophthalmic diagnostics, fostering innovation in automated medical imaging and early disease detection.

KEYWORDS:

Diabetic eye diseases, retinal disorders, deep learning, convolutional neural networks (CNNs), AI in healthcare, fundus imaging, disease detection, transfer learning, medical imaging, ophthalmology AI.

THE UNDERGROUND WARRIOR: IOT BASED DRAINAGE DEFENDER

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ABSTRACT:

The "Advanced Underground Drainage Monitoring and Automatic Rescue System Using Internet of Things" (IoT) is an innovative safety solution designed to enhance both the safety and efficiency of underground drainage operations. This system utilizes IoT technology to continuously monitor environmental conditions, including the presence of hazardous gases such as toxic gases and CO2, along with other critical parameters like temperature and humidity. It also tracks workers' vital signs, including heart rate and blood oxygen levels, providing real-time data to detect potential health risks and ensure workers' safety during operations. When hazardous conditions, such as high levels of CO2 or toxic gases, are detected, the system triggers automated alerts to notify both workers and supervisors, ensuring immediate action. The system also features an automatic rescue mechanism that activates safety protocols to evacuate workers from dangerous environments, reducing the risk of injury or fatality. The IoT-enabled system enables real-time monitoring of both environmental hazards and worker health, facilitating swift intervention during emergencies. Supervisors can remotely access live data, making it possible to make timely, informed decisions for emergency management. This system not only improves the safety of workers but also enhances operational efficiency by proactively identifying hazards and minimizing downtime. With the inclusion of CO2 gas detection and toxic gas monitoring, the system ensures comprehensive safety coverage in underground drainage operations, providing a significant improvement over traditional safety measure.

KEYWORDS:

IoT, Real-time monitoring, Toxic gases, Automatic Rescue System

ICRTT-2025

(2nd May 2025)

BACHELOR OF ENGINEERING -

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

AR BASED LEARNING AND CAREER GUIDANCE PLATFORM

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ABSTRACT:

Career guidance to students is usually hampered by the unavailability of custom, interactive, and interesting assessment methods. Standard psychometric tests are incapable of measuring the true-life interests and hands on skills of students efficiently. This paper offers an Augmented Reality (AR)-Based Learning and Career Guidance Platform that utilizes AR, AI-enabled psychometric tests, and activity-based assessments to suggest ideal careers to students. The system incorporates AR career simulations, through which students can experience various careers in a real and interactive way.

KEYWORDS:

Augmented Reality (AR), Career Guidance, AI-driven Psychometric Assessment, AR Career Simulation, Personalized Career Recommendation, Educational Technology, Experiential Learning.

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REVIEW PAPER ON MONITORING STRUCTURAL INTEGRITY AND WATER LEVELS AND ADVANCED TECHNIQUES FOR CRACK DETECTION

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ABSTRACT:

This study presents a unified approach to enhancing infrastructure monitoring and water resource management using advanced digital technologies. The first part focuses on automated pavement crack detection through an ensemble of convolutional neural networks (CNNs) without pooling layers. This method improves spatial accuracy and, combined with structured prediction and probability fusion, delivers high performance in detecting and measuring various crack types. Morphological analysis and skeleton extraction further enable precise crack width and length estimation, validated on benchmark datasets with superior results compared to traditional methods. The second part introduces a digital twin-based platform for dam and watershed management, developed for Korea's Sumjin River basin. The platform integrates high-resolution 3D geospatial modeling using aerial LiDAR and drone photo grammetry with real-time data on dam operations, rainfall, and river conditions. It supports smart decision- making through AI-powered water level prediction, flood simulation, and levee safety evaluation. The platform also incorporates automated drones and AI-driven CCTV monitoring for enhanced surveillance and response. Together, these solutions demonstrate how deep learning and digital twin technologies can modernize civil infrastructure, enabling accurate monitoring, proactive planning, and data-driven decision-making for safer and more sustainable systems.

KEYWORDS:

Automated pavement crack detection, Deep learning ,Ensemble network, Convolutional neural network, Segmentation, Morphological, Dam, River management, Watershed, Water resource.

A REVIEW OF LOW-COST AND MACHINE LEARNING-DRIVEN BCI CONTROL ARCHITECTURES

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ABSTRACT:

The advancement of brain-computer interface (BCI)- controlled electric wheelchairs has attracted significant interest for facilitating mobility among individuals with severe physical disabilities. This review examines two notable yet distinct methodologies within EEG-based wheelchair control systems. The first approach focuses on an economical design that utilizes single-channel EEG signals to identify attention levels and eye blinks for intuitive navigation. It includes features such as destination mapping and straightforward calibration, specifically targeting users in resource-constrained environments. Conversely, the second study introduces a more complex technique that utilizes multi-channel EEG data, employs Fast Fourier Transform (FFT) for feature extraction, and applies Online Sequential Extreme Learning Machine (OS- ELM) to classify facial expressions into commands for the wheelchair, achieving a classification accuracy of 97.62%. Collectively, these studies illustrate the range of innovation in BCI-driven assistive technologies, from budget-friendly, user-centric designs to precision systems enhanced by machine learning. This review synthesizes their methodologies, performance metrics, and socio-technological implications, offering insights into current trends and future prospects in the field of smart mobility for individuals with disabilities

KEYWORDS:

Brain-Computer Interface (BCI), EEG, Smart Wheelchair, OS-ELM,Signal Processing, Assistive Technology, Low-Cost Design.

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PROXIMITY-BASED ALARM SYSTEM FOR CHILD SAFETY NEAR OPEN BOREWELLS & DRAINS

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ABSTRACT:

The work presented here focuses on designing a safety mechanism using proximity sensors and alarm systems to prevent children from falling into uncovered bore wells or open drainage pits. The system detects movement within a 1–10 foot range and triggers an audible alert for timely action. By using sensor-based technology, this solution tackles a serious and recurring safety issue. It supports real-time hazard detection and gives immediate warnings in public spaces. The set up is low-cost, easy to use, and suitable for both rural and urban areas. This method plays an important role in improving safety near open and dangerous zones.

KEYWORDS:

Borewell safety, proximity sensor, child protection, hazard detection, real-time alert, public safety, cost-effective solution, open drainage monitoring.

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THE IOT-BASED RURAL WATER SUPPLY MANAGEMENT SYSTEM

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ABSTRACT:

The IoT-based Rural Water Supply Management System of this paper is aimed at automating water monitoring, assessment of water quality and distribution of water in such a way that supplies are safely procured and wastage is brought down to minimum. The system that monitors the water levels and purity does so using an ESP32 microcontroller, ultrasonic sensor and water quality sensor. The Flow Sensors regulate distribution with relay-controlled valves and the Blynk app covers real time monitoring with SMS alerts as a means of user notification. The solution creates water conservation, saves labor effort and maintains water management in rural areas.

KEYWORDS:

IoT, Water Level Monitoring, Smart water distribution, ESP32, Ultrasonic Sensor, Water quality monitoring, Flow sensor, Blynk app, Automated water system.

EXPLORING THE NVIDIA JETSON NANO:A GATEWAY TO AI-POWERED EDGE COMPUTING

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ABSTRACT:

This paper explores the capabilities and applications of the Jetson Nano, comparing it with other development boards. The NVIDIA Jetson Nano is a compact, high-performance platform designed for AI, robotics, and IoT applications, offering CUDA-enabled GPU support for deep learning and computer vision.Unlike Arduino Uno, ESP32, and Raspberry Pi3B+,which lack the processing power and GPU acceleration forreal-time AI tasks, the Jetson Nano excels in edge AI computing. This paper explores its capabilities, compares it with other development boards, and demonstrates its ease of use through an LED blinking experiment. With its AI-optimized architecture, scalability, and affordability, the Jetson Nano is driving advancements in intelligent automation and embedded machine learning, making AI-powered solutions more accessible than ever.

KEYWORDS:

NVIDIA Jetson Nano , Embedded System, IoT, Artificial Intelligence.

PIEZO ELECTRIC FLOOR MAT FOR ENERGY HARVESTING

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ABSTRACT:

Alternative energy harvesting technologies are becoming more popular as the need for sustainable energy solutions increases. By transforming the mechanical pressure from footsteps into electrical energy, piezoelectric floor mats offer a novel method of producing electricity.These mats effectively capture energy by using materials such as lead zirconatetitanate(PZT) and polyvinylidene fluoride (PVDF). This study investigates their energy storage techniques, circuit design, material selection, and operating principles. There is also discussion of applications in public areas, IoT-based energy systems, and smart infrastructure. Large-scale adoption is still hampered by issues like low power output, material durability, and cost despite their potential.A more workable and scalable piezo electric energy harvesting solution is made possible by this review, which highlights important research gaps and offers solutions to improve affordability and efficiency.

KEYWORDS:

Piezo electric energy harvesting, smartflooring, PZT, renewable energy, IoT, energy storage.

ECOMARINE:SMART BOAT FOR PLASTIC-FREE WATERS

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ABSTRACT:

This project conceives of a low-cost, AI/ML-capable robotic boat specifically designed for autonomous waste collection and pollution removal from oceans and rivers. The boat possesses a computer vision system driven by AI that is capable of detecting and classifying various types of trash—floating wreckage, plastic bottles, and natural debris—on the fly. Navigation is enhanced through machine learning algorithms that process environmental data such as waste concentration, water currents, and hazard. This enables the boat to dynamically adjust direction, optimize efficiency, and cover waste areas. The system is self-contained, reducing the amount of human intervention and delivering a smart, data-driven solution to ocean cleanup.

Besides waste collection, the boat also integrates advanced pollutant-removal technologies, including oil-absorbing sponges to control surface oil spills and fine microplastic filters to eliminate poisonous, invisible particles. With a modular construction, the boat allows for ease of maintenance, component replacement, and scalability on various water bodies such as lakes, rivers, ports, and city canals. The functionality is complemented by renewable energy sources such as solar panels and real-time monitoring via IoT connectivity. Utilization of Industry 4.0 technologies, the robotic boat employs automation, data analytics, and intelligent decision- making to provide a scalable and sustainable solution to water pollution. Not only is this project focusing on environmental problems but also advocating for clean and healthy environments for future generations.

KEYWORDS:

Microplastic Filtration, Environmental Sustainability, Autonomous Waste Collection, Pollutant Removal, AI-Powered Navigation, Computer Vision, Machine Learning

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AN IOT BASED AUTOMATIC VEHICLE ACCIDENT DETECTION AND VISUAL SITUATION REPORTING SYSTEM

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ABSTRACT:

The Internet of Things (IoT) has revolutionized various industries, including transportation, by enhancing safety, monitoring, and real-time communication. This paper proposes an IoT-based Automatic Vehicle Accident Detection and Visual Situation Reporting System, designed to detect vehicle accidents and provide immediate situational awareness to emergency responders and concerned authorities. The system uses a combination of sensors, including accelerometers, vibration sensor, GPS, and embedded in the vehicle to monitor its status continuously. When an accident is detected based on predefined thresholds for sudden changes in velocity, orientation, or impact force, the system automatically triggers an alert, transmitting real-time data to a cloud-based server.

KEYWORDS:

Enhancing safety, real-time communication, Automatic Vehicle Accident Detection, emergency responders, velocity, orientation, impact force

HYBRID CMOS-MEMRISTOR BASED LOGIC GATES DESIGN

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ABSTRACT:

The creation of the most advanced logic systems requires the use of small, low-power devices with extremely high processing speeds. The Hybrid CMOS-Memristor notably satisfies these requirements and is a key component in digital circuit design. In this work, design, implementation, and performance evaluation of Hybrid CMOS-Memristor based logic gates, such as NOT, AND, NAND, OR, NOR, XOR, and XNOR, are presented via SPECTRE in Cadence Virtuoso. Herein, an optimized design of Hybrid CMOS-Memristor based logic gates have been drawn for a comparative analysis with the conventional 180-nm complementary metal oxide semiconductor (CMOS) technology. The area, power, and delay calculated from these combinational circuits are found to be reduced by more than 75%, 50%, and 60%, respectively, as compared to the conventional CMOS technology. The impact of multiple CMOS technology nodes (90 and 180 nm) on the power consumption at the chip-level logic circuit implementation has also been investigated. The adopted Hybrid CMOS-memristor based design significantly improves the performance of various logic designs, which makes it area and power efficient and enables a major breakthrough in designing various low-power, low-cost, ultrafast, and compact circuits.

KEYWORDS:

Hybrid CMOS-Memristor, SPECTRE, complementary metal oxide semiconductor (CMOS)

SMART AIR QUALITY MONITORING AND PURIFICATION SYSTEM WITH ODOR CONTROL

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ABSTRACT:

Industrial air pollution significantly affects worker health, productivity, and environmental quality. Traditional air monitoring systems often depend on manual supervision and lack real time purification and odor control features, making them inefficient for modern industrial needs. To address these challenges, this project proposes a Smart Air Quality Monitoring and Purification System with Odor Control, designed specifically for industrial applications. The system utilizes MQ-7, MQ-135, and MQ-2 sensors to detect harmful gases such as carbon monoxide, ammonia, and smoke in real time. The data from these sensors is processed by an Arduino Uno microcontroller, which activates a filtration unit, air modifier, fragrance dispenser, and fan system when pollutant levels exceed safe thresholds. This automated system not only purifies the air but also neutralizes unpleasant odors, ensuring a healthier working environment. An LED display provides real-time air quality updates for easy monitoring. The system's smart control mechanism ensures energy-efficient operation by activating purification only when necessary. Compared to traditional methods, this IoT- based solution offers automated control, improved accuracy, reduced human intervention, and scalability for different industrial environments. The project aims to promote sustainable industrial practices, enhance worker safety, and contribute to environmental protection by delivering an efficient and intelligent air quality management system.

KEYWORDS:

Air Quality Monitoring, IoT-Based System, Gas Sensors, Air Purification, Odor Control, Industrial Automation.

AI/ML MODEL GENERATION FOR INDUSTRIAL SECTOR-DEFECT DETECTION IN BOTTLE MANUFACTURING AND HUMAN POSTURE ESTIMATION FOR MANPOWER PRODUCTIVITY IMPROVEMENT

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ABSTRACT:

The integration of AI/ML in industrial automation is revolutionizing quality control and workforce efficiency. This project focuses on developing AI models for defect detection in bottle manufacturing and human posture estimation for manpower productivity improvement. The defect detection system employs deep learning-based computer vision techniques to identify surface imperfections ,shape deviations, and other anomalies in bottles, ensuring real-time quality assessment and minimizing production waste. Simultaneously, the posture estimation model leverages pose detection frameworks to monitor worker movements, identify incorrect postures, and provide actionable insights for ergonomic improvements, thereby enhancing workplace safety and efficiency. The scope of work includes data collection using industrial cameras and sensors, model training with CNNs and pose estimation algorithms, and deployment on edge devices like Raspberry Pi for real-time inference. By integrating AI-powered analytics into manufacturing and workforce management, this project aims to improve product quality, reduce operational costs, and optimize manpower productivity, contributing to the Industry 4.0 transformation.

KEYWORDS:

AI models, human posture estimation, posture estimation model leverages, ergonomic improvements

DESIGN AND OPTIMIZATION OF A 5.8 GHZ MICROSTRIP PATCH ANTENNA FOR RFID SYSTEMS ISM BAND

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ABSTRACT:

This paper introduces, miniaturized antenna solution optimized for wearable devices operating in the 5.8GHz ISM band. The proposed design features a circular patch structure excited via probe feeding and built on a cost-effective FR4 substrate. Emphasis is placed on achieving compactness, mechanical robustness, and safety for on-body use. Simulation results show strong per**formance metrics, including wide** bandwidth, moderate gain , and low return loss. Specific Absorption Rate(SAR) analysis confirms the antenna's compliance with international exposure standards, making it suitable for prolonged skin contact. The combination of affordability, practical design, and reliable performance positions this antenna as a viable candidate for integration into modern wearable platforms such as smart watches, health monitors, and fitness devices.

KEYWORDS:

Miniaturized antenna, probe feeding, Specific Absorption Rate(SAR)

RAG DRIVEN VIRTUAL ASSISTANT FOR ENHANCING CANDIDATE EXPERIENCE.

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ABSTRACT:

Recently, information retrieval and synthesis approaches have under gone a significant transformation with the advancement of information technology, especially artificial intelligence. However, the application of artificial intelligence in supporting candidates in gathering companies' information during recruitment processes remains limited. This research proposes a question answering system using Retrieval Augmented Generation (RAG) techniques to support recruitment interviews. Company-related data is collected from multiple sources (corporate websites, reports, forums) then processed and stored in a database as a unique knowledge base. After that, RAG models are applied to construct query and response systems that support candidates throughout the interview session. Within the scope of this study, data was aggregated from 20 different companies, and various RAG techniques were analyzed in a comparative manner. The result shows that all RAG models could generate responses with an accuracy of up to 91%, indicating the potential for practical implementation and expansion across diverse domains.

KEYWORDS:

Chatbot, recruit, interview, Multi query

DEVELOPMENT OF A SMART AND EFFICIENT INSTRUCTION DETECTION SYSTEM

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ABSTRACT:

This report presents a comprehensive study on developing an Instruction Detection System (IDS) utilizing advanced machine learning algorithms to enhance network security. The research aims to address the growing challenges posed by cyber threats through a multi-stage framework incorporating data normalization, feature selection, and hyper parameter optimization. The proposed system leverages Particle Swarm Optimization (PSO) in conjunction with random Forest and Support Vector Machine (SVM) algorithms to improve detection accuracy and reduce false positive rates. The system's effectiveness is evaluated using benchmark datasets, including UNSW-NB15 and KDDCUP99, Which provide a robust foundation for assessing performance metrics such as accuracy, precision, recall, and F1-score. The findings indicate that the hybrid approach not only enhances the detection capabilities of the IDS but also contributes to the academic discourse on machine learning applications in cybersecurity. This research underscores the importance of algorithm selection, data processing, and feature engineering in developing effective intrusion detection systems, ultimately aiming to fortify network defenses against evolving cyber threats.

KEYWORDS:

Machine Learning, Support Vector Machine, cyber security.

COMPACT WIDEBAND FLEXIBLE IMPLANTABLE SLOT ANTENNA WITH ENHANCED GAIN

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ABSTRACT:

This paper presents a compact, wideband, dual-ring slot antenna with coplanar waveguide (CPW) feeding, developed for biomedical applications operating in the ISM frequency band. The antenna is designed to be implantable, using biocompatible and flexible substrate-superstrate materials that provide insulation within the human body. Although the antenna exhibits satisfactory performance, its gain is relatively low, measuring around −12 dB. To address this limitation, a metamaterial (MTM) array exhibiting epsilon very large (EVL) characteristics is incorporated on the antenna's superstrate layer. The integration of the MTM structure results in an approximate 3 dB improvement in gain. Importantly, the antenna retains its wideband and flexible properties even after the inclusion of the MTM. Furthermore, a specific absorption rate (SAR) analysis is performed for both MTM-enhanced and non-enhanced versions, showing low SAR levels in each case where the maximum permissible SAR is 1.6 W/kg averaged over 1 gram of tissue. Experimental validation is conducted through in-vitro testing, where the antenna is immersed in a tissue-mimicking gel and embedded in a chicken breast sample to simulate real-world conditions.

KEYWORDS:

Implantable Antenna, Flexible , Wideband, Compact, Biomedical application, Gain enhancement.

ORGANIC 6G CONTINUUM ARCHITECTURE: A UNIFORM CONTROL PLANE ACROSS DEVICES, RADIO AND CORE

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ABSTRACT:

The upcoming 6G era demands a shift from fragmented control systems to a unified, intelligent network architecture. The Organic 6G Continuum introduces a **Uniform Control Plane (UCP)** that seamlessly manages communication and control across User Equipment (UE), Radio Access Network (RAN), and Core Network (CN). Unlike 5G's Service-Based Architecture (SBA), which separates these layers and increases signalling overhead, the Organic 6G model proposes a stateless, context-aware framework featuring the **reduced Service Communication Proxy (rSCP)**. This component enables smart coordination and flexible service deployment across the network continuum, thereby simplifying operations and enabling real-time responsiveness.

In our project, we simulate this concept using a **Flask-based UCP controller** and micro services representing the UE, RAN, and Core. A web interface allows users to send and log control commands in realtime, validating the feasibility of centralized, intelligent network control. This approach showcases how Organic 6G can reduce complexity, improve responsiveness, and support laying a strong foundation for future 6G networks that demand seamless, adaptive, and low-latency service delivery.

KEYWORDS:

Fragmented control systems, Uniform Control Plane (UCP), Service-Based Architecture (SBA), Core Network (CN), adio Access Network (RAN), reduced Service Communication Proxy (rSCP).

ADVANCES IN BONE CONDUCTION AUDIO TECHNOLOGY: A REVIEW OF CROSSTALK CANCELLATION, VIBRATION SENSING, AND SPEECH INTELLIGIBILITY

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ABSTRACT:

Bone conduction (BC) audio technology offers a compelling alternative to traditional air conduction, particularly for individuals with conductive hearing loss and for use in noisy environments. However, its practical implementation faces several challenges, including signal crosstalk between ears, reduced speech intelligibility, and limited sensor performance in compact devices. This review synthesizes recent advances in BC audio systems across five key studies, focusing on crosstalk cancellation techniques, high-performance MEMS-based vibration sensors, and methods to enhance speech intelligibility. We examine adaptive real-time filtering platforms, accelerometer-based cancellation zones, and active control using oto acoustic emission measurements, along with novel filter designs and sensor architectures. Strengths, limitations, and performance metrics of each approach are analyzed. The review highlights the growing potential of integrated BC solutions while identifying key areas for future development, such as higher- frequency cancellation, miniaturization, and user-specific adaptation.

KEYWORDS:

Bone conduction, crosstalk cancellation, MEMS vibration sensor, speech intelligibility, FxLMS, real-time audio processing

SMART SPECTRUM SHARING AND SENSING IN COGNITIVE RADIO NETWORK

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ABSTRACT:

Cognitive Radio Networks (CRNs) have emerged as a powerful solution to the growing problem of spectrum scarcity in wireless communications. These networks allow un licensed users(secondary users)to opportunistically access the underutilized spectrum bands without interfering with licensed users (primary users). This paper explores the integration of intelligent spectrum sensing an dynamic spectrum sharing mechanisms to enhance the overall efficiency and reliability of CRNs.

Spectrum sensing is a fundamental task in CRNs, enabling the detection of idle channels. Traditional sensing methods like energy detection or matched filtering often face challenges in noisy or dynamic environments .To overcome these limitations, we propose the use of machine learning-based sensing techniques, such as supervised and reinforcement learning models, which can adapt to the radio environment and improve the accuracy of detection.

Simulation results demonstrate that the intelligent spectrum sensing and sharing approach significantly improves key performance metrics such as throughput, spectrum utilization, and interference management. Compared to static or rule-based systems, our smart CRN model offers greater flexibility and efficiency, especially in dense and heterogeneous environments.

It enables more efficient use of the spectrum, ensures coexistence with primary users, and lays the foundation for future wireless technologies such as 5G, IoT, and beyond.

KEYWORDS:

Cognitive Radio Networks (CRNs), learning-based sensing techniques, supervised and reinforcement learning models, throughput, spectrum utilization

ICRTT - 2025

(2nd May 2025)

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RFID-ENABLED INTELLIGENT CONTROLLER FOR SEAMLESS E-BIKE ACCESS AT URBAN TOLL GATES

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ABSTRACT:

The paper addresses the increasing demand for electric motor bicycles in India, driven by their advantages, including reduced air pollution, lower maintenance costs, and minimal noise Furthermore this study explores the implementation of an intelligent controller for managing electric bicycles (e-bikes) at toll-free gates, facilitating their seamless integration into existing tolling systems. As urban mobility shifts toward sustainable transportation, e-bikes have gained popularity due to their efficiency and minimal environmental impact. However, integrating them into toll systems designed primarily for motor vehicles presents challenges. This research proposes an intelligent controller capable of distinguishing e-bikes from traditional motor vehicles, enabling toll-free passage for e-bikes equipped with specific identifiers. By ensuring smooth and automated access, the system promotes e-bike adoption while maintaining toll system integrity.. A cost-effective e-bike model is designed using a Brushless DC (BLDC) motor mounted on the rear wheel, a battery, and a controller to regulate speed and current. The system allows for operation via battery power or pedaling. To validate the proposed model, an Electric Bike Simulator was used for performance analysis, and experimental results were demonstrated through a hardware assembly kit. The findings highlight the feasibility and efficiency of the intelligent controller in enhancing the accessibility and adoption of e-bikes in urban environments.

KEYWORDS:

Electric Bicycles (E-Bikes), Intelligent Controller, Toll-Free Access, Sustainable Transportation, BLDC Motor

INSTANT POWER PRODUCTION USING PIEZOELECTRIC SENSOR DEDICATED TO SMART PHONE

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ABSTRACT:

The increasing demand for instant and sustainable power sources for mobile phones has become critical due to limited battery life, longer charging times, energy depletion during emergencies. This project aims to develop an efficient and low cost piezoelectric power generation system to instantly charge mobile phones by converting mechanical energy from human activity such as tapping or pressing surfaces into electrical energy using piezoelectric sensors. The proposed system consist of a high output piezoelectric sensor integrated with a voltage booster circuit and rectification unit to convert mechanical energy into a stable DC power output suitable for mobile phone charging. Additionally, a microcontroller-based energy storage unit is designed to store surplus energy and ensure a continuous power supply. This system is particularly beneficial in emergency situations, remote areas, outdoor environments and power outages, where conventional power sources are unavailable. The project supports green energy harvesting by utilizing renewable mechanical energy, reducing reliance on grid electricity, and minimizing carbon footprints. Experimental results indicate the system can generate 5-10 watts of power 50 surface taps, capable of charging mobile phone up to 50% in less than an hour. This technology has potential to revolutionize mobile phone charging systems by offering a portable, eco-friendly, and self-sustainable power source. In the future, it can be expanded for wearable electronics, IOT devices, and self-powered systems, thereby promoting a sustainable and energy-independent environment.

KEYWORDS:

IOT, Piezoelectric sensor, microcontroller based energy storage, self powered system.

ALL – DAY POWER GENERATION USING SOLARPV–THERMOELECTRIC GENERATOR HYBRID

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ABSTRACT:

This study focuses on developing and investigating a hybrid nighttime electric power generator that integrates photovoltaic (PV)cells with thermo electric generators (TEG)to provide continuous power generation during both day and night. During the day, PV cells efficiently capture solar energy and convert it into electricity. At night, radiative cooling lowers the surface temperature of the PV panels, creating a temperature differential between the ambient air and the cooled panels. This temperature difference drives the TEG modules, which generate electricity based on the Seebeck effect. The experimental results reveal that the size and configuration of TEG modules significantly affect power output. A single 3cm×3cm TEG produced up to 0.9mW of power with a 55°C temperature difference, while a larger 4cm×4cm TEG generated upto 3.8mW. Furthermore, connecting two 4cm×4cm TEGs in series resulted in a peak output of 7.7mW, nearly double that of the single TEG setup. This hybrid system demonstrates potential for moderate nighttime power generation, suitable for small household applications such as LED lights, laptops, phone chargers, and wireless routers. The ability to generate power both during the day and night enhances the efficiency and reliability of renewable energy systems, offering a continuous, sustainable power supply that mitigates the limitations of conventional solar panels. The results under score the feasibility of scaling up TEG modules to achieve higher power outputs, making this system a promising solution for addressing nighttime energy demands in off-grid and low- power applications.

KEYWORDS:

Photovoltaic cells, Thermo electric generator, Hybrid system

FABRICATION OF ADVANCING BIOMATERIAL-BASED TRIBOELECTRIC NANOGENERATORS (BM-TENGS): OPPORTUNITIES, CHALLENGES, AND FUTURE PROSPECTS IN MEDICAL APPLICATIONS

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ABSTRACT:

The growing demand for customized healthcare services has highlighted the significance of biomaterial-based tribo electric nano generators (BM-TENGs) due to their non-toxic, biocompatible, and biodegradable properties. This review provides a detailed examination of the operational principles, material choices, bio mimetic designs, and clinical applications of BM-TENGs, emphasizing the utilization of natural biomaterials, bio composites, hydrogels, and other materials in health diagnostics. Biomaterials significantly enhance TENG performance, flexibility, and applicability, particularly in early disease detection, health monitoring, and self-powered sensing devices. By synthesizing existing research and technological progress, this paper aims to provide an in-depth understanding of BM-TENG advancements, propose solutions to current limitations, and explore their practical applications in medicine. This paper presents a wearable tribo electric nano generator (TENG)-based respiratory monitoring system capable of real-time breathing pattern analysis without the need for an external power source. The device incorporates silk fibroin as the positive tribo electric layer, polyethylene terephthalate (PET) film as the negative layer, graphite-coated paper with aluminum foil as electrodes, and thermoplastic polyurethane (TPU) film for encapsulation and structural support. This work demonstrates strong potential for applications in smart masks, fitness tracking, medical diagnostics, and personalized healthcare, offering a scalable, self-powered, and real-time respiratory monitoring platform.

KEYWORDS:

Biomaterials, Triboelectric nanogenerator, Biomimicry, Healthcare, Self-powered devices, Wearable Devices, Respiratory monitoring System.

IOT BASED E- VEHICLE MONITORING AND FAULT-FINDING SYSTEM

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ABSTRACT:

Solar-Powered EV Vehicle Monitoring and Fault-Finding System using a microcontroller, IoT, and various sensors to enhance efficiency, reliability, and sustainability. A solar panel charges the vehicle's battery, reducing dependency on external power sources. The system continuously monitors key parameters such as battery voltage, current consumption, and motor speed using voltage and current sensors. A speed control mechanism ensures optimal motor performance while preventing overload conditions. Data from these sensors is processed by the microcontroller and transmitted to an IoT- based platform, allowing users to monitor the EV's status remotely. Additionally, a fault detection system to identify failures, triggering alerts for maintenance. This system enhances the reliability and efficiency of solar-powered electric vehicles, making them smarter and more sustainable.

KEYWORDS:

Distortion otoacoustic, Hearing screening, Low cost, Medical auditory system, Microcontroller.

AUTOMATED DUAL AXIS SOLAR TRACKER INTEGRATED WITH WEATHER SENSING

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ABSTRACT:

To maximize solar energy capture and enhance agricultural irrigation, the study introduces an Automated Dual Axis Solar Tracker Integrated with Weather Sensing. While integrated weather sensors keep an eye on the surrounding surroundings for real-time modifications, the dual-axis tracker modifies solar panels for optimal exposure to sunlight. Up to 40% less water is wasted thanks to the system's ability to control an automated watering system based on soil moisture levels. The findings of the experiment demonstrated a considerable reduction in water consumption and a 25–30% increase in energy output. This environmentally friendly solution improves crop output, lowers operating costs for both small and big farms, and is perfect for areas with limited water and electricity.

KEYWORDS:

Dual Axis solar Tracker, Weather Monitoring System, Smart Irrigation System, Soil Moisture Monitoring, Water Conservation , Renewable Energy Optimization.

AI-DRIVEN REAL-TIME POWER DISTRIBUTION IN RENEWABLE ENERGY-BASED SMART GRID EV CHARGING

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ABSTRACT:

The increasing adoption of electric vehicles (EVs) necessitates an intelligent and adaptive power distribution strategy to ensure grid stability while maximizing renewable energy utilization. This paper proposes an AI-driven real-time power distribution framework for EV charging stations integrated with a renewable energy-based smart grid. The framework leverages reinforcement learning (RL) and deep learning models to dynamically allocate power based on real-time demand, grid constraints, and renewable energy availability. By predicting charging demand patterns and optimizing power distribution, the proposed approach minimizes grid overload, reduces reliance on fossil fuel-based energy sources, and enhances overall charging efficiency. Simulation results demonstrate the effectiveness of the model in balancing grid stability, user convenience, and energy sustainability. This study contributes to the advancement of AI-enabled smart grids by showcasing a robust and scalable power distribution mechanism tailored for future energy ecosystems.

KEYWORDS:

AI-driven power distribution, smart grid, renewable energy integration.

RASPBERRY PI POWERED AUTOMATED PLANT WATERING SYSTEM

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ABSTRACT:

Efficient water management and plant health monitoring are critical in modern agriculture. This project presents a Raspberry Pi-powered automated plant watering system that integrates soil moisture sensing, plant disease detection, and Digital Signal Processing (DSP) techniques for enhanced decision-making. The system employs a soil moisture sensor to monitor soil conditions, activating a relay-controlled water pump when the soil is dry and turning it off when optimal moisture levels are reached. Additionally, plant disease detection is implemented to identify potential plant health issues, triggering the water pump as a preventive measure. The Raspberry Pi serves as the central processing unit, analyzing sensor data and disease patterns using DSP techniques for signal filtering and feature extraction. The system operates autonomously and can be powered by a battery, ensuring uninterrupted functionality. This smart irrigation system not only optimizes water usage but also enhances plant health monitoring, making it a valuable solution for precision agriculture and smart farming applications.

KEYWORDS:

Smart irrigation; Raspberry Pi; soil moisture sensor; digital signal processing.

Hospital Inspection Using Audit AI

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ABSTRACT:

Ensuring the safety of medical supplies is vital for healthcare management. This project employs a multimodal large language model (LLM) to automate hospital inspections by analyzing medicines through visual and textual inputs. The system detects expired, damaged, or tampered medicines, reducing human error and enhancing efficiency. Built with Django (backend) and React (frontend), the model integrates with hospital inventory systems for real-time auditing. This scalable solution improves regulatory compliance and patient safety, with potential future enhancements in EHR integration and supply chain monitoring.

KEYWORDS:

Medical Auditing, Multimodal AI, LLM, Hospital Inspections, Django, React, Automated Inventory Management, Patient Safety

Deep Learning-Based Gesture Recognition System for Smart Automation

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ABSTRACT:

In an era increasingly defined by touchless interaction and intelligent control systems, this project introduces a deep learning-based gesture recognition system for smart automation. Utilizing Convolutional Neural Networks (CNNs), the system accurately interprets hand gestures from a real-time camera feed to intuitively control electronic devices. By eliminating the need for physical interfaces, it promotes hygienic, accessible, and futuristic interactions—making it particularly impactful in environments such as industrial automation, smart homes, and assistive technologies. The model is trained on a diverse dataset comprising both static and dynamic hand gestures to ensure high accuracy, robustness, and adaptability to real-world scenarios. This innovation represents a step forward in human-machine interaction, where natural human movements drive seamless and intelligent control.

KEYWORDS:

Gesture Recognition, Deep Learning, Convolutional Neural Networks (CNNs),Smart Automation, Human Machine Interaction, Touchless Control.

WIRELESS SENSOR AND ACTUATOR NETWORK BASED ENERGY MONITORING AND CONTROL SYSTEM FOR HOMES

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ABSTRACT:

The rising global energy demand and the need for sustainable solutions highlight the importance of advanced energy management in homes. Traditional systems often fail to meet the dynamic requirements of modern households. This project introduces a Wireless Sensor and Actuator Network (WSAN)-based energy management and control system designed for residential use. The system enables real time monitoring and control of energy consumption using WSAN to optimize usage, minimize waste, and improve efficiency. By integrating sensors and actuators, it collects and analyzes appliance-level data to provide actionable insights for homeowners. The proposed system offers a scalable, cost effective, and user-friendly alternative to conventional solutions, contributing to energy conservation and promoting sustainable living through intelligent energy management.

KEYWORDS:

Home Energy Management System,Load Control, Monitoring, ESP32.

DEVELOPMENT AND CHARACTERIZATION OF PONGAMIA BASED ESTER OIL FOR TRANSFORMER LIQUID INSULATION

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ABSTRACT:

As the transformer sector is diving towards shifting of mineral oils to natural ester based oils with similar or closer properties as that of mineral oil ,this research explores the possibility of using natural Pongamia based [PE] oil as insulating liquid for power transformers that has emerged as a promising alternative to traditional mineral oils. This study details the production of Pongamia based ester oils through the esterification of raw vegetable oils extracted from Pongamia seeds .The characterization to evaluate the suitability of PE oil for transformer insulation applications is reported in this paper . The methodology encompasses esterification, chemical analysis, dielectric testing, and thermal stability assessments. The results excellently showcase that Pongamia ester oils possess high dielectric strength, improved thermal stability, and superior fire-resistant property compared to mineral oil. Also the superior performance of PE oil makes it suitable to avert any situations in connection towards environmental impact, safety, and operational efficiency. Also the natural PE oil with its desired performance characteristics has the ability to surpass mineral oil for transformer insulation, providing a safer, greener, and more sustainable solution.

KEYWORDS:

Pongamia, Esterification, dielectric testing, transformer liquid.

DEVELOPMENT OF A SMART PREPAID ELECTRIC VEHICLE CHARGING INFRASTRUCTURE FOR URBAN MOBILITY

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ABSTRACT:

The rapid growth of electric vehicles (EVs) presents both opportunities and challenges for urban mobility systems. This study focuses on the development of a smart prepaid electric vehicle charging infrastructure aimed at enhancing convenience, accessibility, and efficiency in urban environments. The proposed system integrates IoT-based smart meters, mobile applications, and cloud computing to enable seamless prepaid transactions, real-time monitoring, and data driven energy management. Users can recharge their prepaid accounts via mobile platforms and locate nearby charging stations equipped with smart meters that authenticate user access, track consumption, and deduct credit accordingly. This infrastructure not only simplifies the payment process but also helps reduce operational costs, supports energy optimization, and enables dynamic pricing based on demand. Moreover, the system contributes to grid stability by allowing utility providers to manage load distribution intelligently. The integration of data analytics further enhances user experience and infrastructure planning by providing valuable insights into charging patterns and energy demand. By addressing the technical and logistical limitations of current charging systems, this smart prepaid model supports the transition to sustainable urban transportation, ensuring scalability, efficiency, and user-centric services in modern cities. This research underscores the importance of technological innovation in transforming EV charging ecosystems for the future of urban mobility.

KEYWORDS:

Electric vehicles, smart charging infrastructure, prepaid system, urban mobility, IoT, real-time monitoring, sustainable transportation, smart grid.

Integration of Renewable Energy and IoT-Based Smart Agriculture

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ABSTRACT:

Our project is clearly explain the electricity usage based problems in agriculture field and also it provide the solution for the problem to develop the agriculture field. The agriculture is the main occupation of our country. It need more electrical energy for plants water irrigation. In our country maximum of electrical energy is generated by fossil fuels. It will increase the green gas, pollute the environment and increase the earth temperature. And the Second problem is water demand because of improper rain fall and poor rainwater saving requirements. But the normal irrigation methods are need more water so that it will affect the agriculture production. The solar water pump is used in agriculture irrigation usage to reduce the fossil fuel used energy generation. And this system is integrated with the IoT based smart irrigation system. Because the smart irrigation system have sensors to monitor the moisture, temperature level to reduce the water usage also increase the agriculture production and it improve the farmer economical level. And the user can operate this system in any part of the world.

KEYWORDS:

Solar-powered irrigation, Crop monitoring, Automated farming, Digital agriculture, Cloud-based agriculture ,Digital agriculture platforms

IOT BASED SOLAR POWERED AIR PURIFIER WITH AIR QUALITIY MONITORING SYSTEM

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ABSTRACT:

Air pollution and energy scarcity are major global issues today. Conventional air purifiers depend on non-renewable power sources, making them less eco-friendly. This project proposes an IoT -based solar- powered air purifier system that addresses energy efficiency and pollution control simultaneously. The system uses solar energy to operate the air purifier, ensuring a sustainable source of power. IoT sensors monitor real-time air quality and allow users to track and control the purifier through a mobile application .The system automates purification based on air quality levels, saving energy and enhancing environmental protection. Due to rapid industrialization and urbanization, air pollution levels have risen drastically, affecting human health and the environment. Traditional air purifiers run on electricity, further adding to the carbon footprint . To solve this, we propose an IoT-based solar- powered air purifier

KEYWORDS:

Air pollution, Iot based solar air purifier, Iot sensors.

ELECTRIC VEHICLE MANAGEMENT SYSTEM WITH CHARGE MONITER AND FIRE PROTECTION

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ABSTRACT:

As electric vehicles (EVs) become increasingly prevalent, ensuring battery safety, efficiency, and longevity is critical. This paper presents the design and implementation of an advanced Battery Management System (BMS) equipped with real-time charge monitoring and integrated fire protection features. The system monitors key parameters such as state of charge (SoC), state of health (SoH), temperature, voltage, and current at the cell and pack levels to optimize charging cycles and extend battery life. A tiered protection mechanism is employed, incorporating thermal sensors, smoke detectors, and an emergency disconnection system to prevent thermal runaway and mitigate fire hazards. The BMS also includes wireless communication for remote diagnostics and alerts, enhancing vehicle safety and user awareness. Experimental results demonstrate the system's effectiveness in detecting irregularities and responding promptly to abnormal conditions, making it a reliable solution for modern EV applications.

KEYWORDS:

Battery management system , Fire protection , Real time monitoring , Electric vechicle.

IOT BASED CLOUD COMPUTED AUTOMATION IN ENERGY METER

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ABSTRACT:

The main objective of the project is to develop an IOT (internet of things) based energy meter reading displayed for units consumed and cost there upon over the internet in text format. For this innovative work we had taken a digital energy meter whose blinking LED signal is interfaced to a microcontroller of ARDUINO family through a optical interface. The blinking LED flashes 3200 times for 1 unit. The optical sensor gives an interrupt each time the meter LED flashes to the programmed micro controller. The microcontroller takes this reading and displays it on an LCD duly interfaced to the microcontroller. The reading of the energy meter is also sent to a IoT modem being fed from the microcontroller via level shifter IC and RS232 link. The Node MCU used in the modem being internet enabled transmits the data directly to a dedicated web page for display anywhere in the world in multi-level text format. Also, by using GSM Module, we can send information like energy consumed and cost details to consumers. The power supply consists of a step-down transformer 230/12V, which steps down the voltage to 12V AC. This is converted to DC using a Bridge rectifier and it is then regulated to +5V using a voltage regulator 7805 which is required for the operation of the microcontroller and other components.

KEYWORDS:

Distortion acoustic, Hearing screening, Low cost, Medical auditory system, Microcontroller.

DEEP MALNUTRITION ANALYZER: A VARIATIONAL AUTO ENCODER-BASED APPROACH FOR EARLY DETECTION

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ABSTRACT:

Malnutrition detection using deep learning with a Variational Autoencoder (VAE) aims to analyze physiological and facial features for early diagnosis. The model learns latent representations from medical or facial images to identify malnutrition patterns. By capturing key features, the VAE differentiates between healthy and malnourished individuals. The system enhances diagnosis by detecting subtle variations that may be overlooked in traditional assessments. This approach ensures automated, efficient, and accurate malnutrition screening. The proposed model can assist healthcare professionals in early intervention and treatment planning. The objective of this study is to develop an automated malnutrition detection system using a Variational Autoencoder (VAE) for accurate and early diagnosis. This approach aims to enhance healthcare efficiency by providing a scalable, data-driven screening tool for timely intervention.

KEYWORDS:

Variational Autoencoder, malnutrition screening

ICRTT - 2025

(2nd May 2025)

BACHELOR OF TECHNOLOGY

DEPARTMENT OF INFORMATION TECHNOLOGY

CARDIOVASCULAR DISEASE PREDICTION WITH ML USING RANDOM FOREST CLASSIFIER ALGORITHM:

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ABSTRACT:

Cardiovascular diseases remains a leading cause of mortality worldwide, necessitating improved risk assessment tools that can facilitate early intervention. Machine learning is a crucial tool in such data prediction diagnosis. This plays a vital role in cardiovascular risk analysis which is acting as a life saving factor. This proposed model uses random forest classifier algorithm which is an ensemble predictive model. This algorithm is known for it's accuracy. Also this model interprets easy user interfacing which is used to get accurate data from the user. This research contributes to the field by providing a clinically applicable tool that can efficiently identify high-risk patients who may benefit from preventive measures. The Random Forest approach offers advantages in handling data, maintaining reliability, and mitigating threatening risks. This in turn offers more validated output contributing the feasibility of data. The main objective of this paper is to predict cardiovascular diseases and aiding on the proper preventive diagnosis. The proposed algorithm provides 90% accuracy. Heart related real datasets are picked from Kaggle machine learning repository which offers vast predictability. Using this reliable algorithm is an asset for future renovation of this machine learning model.

KEYWORDS:

cardiovascular disease prediction, Machine learning, Random Forest algorithm, predictive modeling, medical aid .

EARLY ANALYSIS AND PREDICTION OF LUNG CANCE USING MACHINE LEARNING CLASSIFIERS

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ABSTRACT:

Machine Learning (ML) models have been increasingly utilized to analyze clinical data, medical imaging, and patient demographics, showing promising accuracy in various healthcare applications. The field of ML classification models is rapidly evolving, with the potential to significantly enhance diagnostic accuracy and patient outcomes. This proposed research introduces novel ML models designed for the early prediction and analysis of lung cancer, aiming to facilitate timely intervention and improve treatment effectiveness. Keywords: Machine Learning, Clinical Data, Medical Imaging, Patient Demographics, Lung Cancer Prediction

KEYWORDS:

Machine Learning, Clinical Data, Medical Imaging, Patient Demographics, Lung Cancer Prediction

EARLY DRUG DISCOVERY :TARGET IDENTIFICATION AND OPTIMIZATION USING GCN

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ABSTRACT:

Early Drug Discovery using AI The traditional drug discovery process is often hindered by high costs, extended timelines, and low clinical success rates. This research proposes a comprehensive, AI-driven framework to enhance early-stage drug discovery by leveraging advanced deep learning techniques. The framework integrates Protein-Protein Interaction (PPI) networks with Graph Convolutional Networks (GCNs) for accurate target identification. Hit identification is achieved using 3D-Convolutional Neural Networks (3D-CNNs), while Generative Adversarial Networks (GANs) contribute to de novo compound generation. Lead optimization is performed using Reinforcement Learning (RL) and Deep-Q Learning to refine efficacy and reduce toxicity. Additionally, Recurrent Neural Networks (RNNs) are utilized for predicting ADMET (Absorption, Distribution, Metabolism, Excretion, and Toxicity) properties, ensuring pharmacokinetic viability. A user-friendly interface facilitates seamless interaction with the models, enabling data input, visualization, and analysis. The proposed system demonstrates significant improvements in scalability, efficiency, and predictive accuracy, offering a promising direction for cost-effective and clinically successful drug development.

KEYWORDS:

Generative Adversarial Networks (GANs), Reinforcement Learning (RL), Deep-Q Learning

IDENTIFICATION OF MEDICINAL PLANTS

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ABSTRACT:

Creating an automated categorization system for medicinal plants is a time-consuming and challenging task. India is a nation with a varied variety of plant species, each with its unique set of therapeutic qualities. Because it is hard for humans to recall the names of all plant species and their applications, previous knowledge is essential for manual identification and categorization. The preservation of these therapeutic plants is crucial as it will help a broad variety of sectors, including medicine, botanic research, and plant. taxonomy studies, among others. Existing technologies cannot imitate the range of therapeutic plant species present in India. The suggested technique facilitates in the classification of medicinal plants by exploiting textural aspects that are crucial in leaf recognition and identification. The three key phases of the proposed technique are picture enhancement, feature extraction, and classification. The photographs of the leaves are shot using cellphones and then processed using digital image processing algorithms to extract the features that may be compared between them. Finally, the CNN classifier is employed to develop an automated classifier.

KEYWORDS:

ANN, CNN, Deep Learning, DNNs, ReLU

HYBRID TECHNIQUES FOR VISION DETECTION

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ABSTRACT:

This project presents a hybrid technique for vision disorder detection using machine learning algorithms implemented on FPGA. The system follows a structured pipeline that starts with image preprocessing, where input images undergo various transformations such as resizing, noise removal, histogram equalization, gray conversion, and normalization. Feature extraction is performed using advanced techniques like Histogram of Oriented Gradients (HOG) or Local Binary Patterns (LBP) to capture significant texture and shape information. The processed dataset is split into training and testing sets, with 80% used for training the classification model and 20% for testing. Machine learning algorithms such as Random Forest and K-Nearest Neighbors (KNN) are employed for classification, with K-Means clustering further enhancing the model's predictive capabilities. The final output involves predicting the presence of vision disorders from the processed images using an ensemble-based approach. To optimize the hardware implementation, Verilog is used to describe the K-Means algorithm and the ensemble model, employing pipelining and resource-sharing techniques to maximize FPGA resource utilization. The performance of the system is evaluated based on key metrics, including area, power, delay, PSNR, SSIM, MSE, MAE, accuracy, precision, recall, and ROC. The proposed approach not only improves the efficiency of vision disorder detection but also demonstrates the feasibility of FPGA-based hardware acceleration for real-time applications.

KEYWORDS:

Peak Signal-to-Noise Ratio (PSNR), Structural Similarity Index Measure (SSIM).

ICRTT-2025

(2nd May 2025)

BACHELOR OF TECHNOLOGY -

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

MEDICINAL PLANT IDENTIFICATION AND HEALTH-BASED RECOMMENDATION SYSTEM

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ABSTRACT:

Medicinal plants have played a vital role in traditional medicine for centuries. With the increasing demand for natural remedies and the rise of technology, identifying plants and recommending their uses has become a significant research area. This project presents a deep learning-based medicinal plant identification system that takes an image of a plant and identifies its name using a Vision Transformer (ViT) model. Additionally, the system provides medicinal uses of the identified plant and also offers recommendations based on the user's health query using NLP techniques. This dual capability enables both visual recognition and textual recommendations through a web interface. The system leverages custom datasets, JSON-based remedy mappings, and Torch Vision transformations. Our results indicate an effective plant identification model with over 95% accuracy and a user friendly interface capable of supporting healthcare awareness.

KEYWORDS:

Medicinal plants, Vision Transformer, Natural remedies, Deep Learning, Image classification, NLP, Torch Vision, JSON.

AUTOMATED DIABETIC RETINOPATHY DETECTION

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ABSTRACT:

Diabetic Retinopathy (DR) is a leading cause of vision impairment and blindness, particularly among individuals with prolonged diabetes. Early detection is essential for effective intervention and disease management. However, traditional screening methods depend on manual inspection by ophthalmologists, which is labor-intensive, subjective, and unsuitable for large scale deployment. The increasing global incidence of diabetes underscores the urgent need for automated and scalable diagnostic solutions. This project proposes an advanced DR detection framework leveraging the You Only Look Once (YOLO) deep learning model for real time analysis of retinal fundus images. YOLO's object detection capabilities enable the identification of DR specific abnormalities, including micro aneurysms, hemorrhages, and exudates, with high accuracy and speed. The system enhances diagnostic efficiency, reduces the burden on healthcare professionals, and expands access to retinal screening, particularly in underserved regions. Furthermore, the integration of deep learning introduces consistency and reliability into the diagnostic workflow. Future work will explore the incorporation of explainable AI for model transparency and the development of mobile based deployment for remote screening initiatives.

KEYWORDS:

Diabetic Retinopathy, Deep Learning, YOLO, Medical Image Analysis, Fundus Images, Automated Diagnosis.

DESCRIPTIVE ANALYSIS OF SALES DATA TO IMPROVE BUSINESS STRATEGY

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ABSTRACT:

Retailers today rely heavily on data-driven strategies to understand customer behavior and maximize revenue. This project presents a Retail Customer Segmentation and Recommendation System that leverages clustering techniques and association rule mining to categorize customers and recommend products accordingly. Using the K-Means algorithm for segmentation and the Apriori algorithm for product recommendations, the system processes transactional data to generate actionable insights. A user-friendly Stream lit interface allows dynamic customer uploads and real-time visualization of segmentation and product suggestions. The system supports business strategy optimization and enhances customer experience. The recommendations are personalized per customer cluster and the system offers marketing teams the ability to launch cluster-wise email campaigns. Robust preprocessing and modular architecture ensure the tool's adaptability across retail domains. The system is scalable, interpretable, and ready for integration into digital business platforms.

KEYWORDS:

Retail Analytics, Customer Segmentation, K-Means Clustering, Association Rule Mining, Apriori, Stream lit , Recommendation System.

HYBRID MACHINE LEARNING AND DEEP LEARNING APPROACHES FOR BIG DATA PREPROCESSING

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ABSTRACT:

The development of the Internet, cyber-attacks are changing rapidly and the cyber security situation is not optimistic. This survey report describes key literature surveys on machine learning (ML) and deep learning (DL) methods for network analysis of intrusion detection and provides a brief tutorial description of each ML / DL method. Projects representing each method were indexed, read, and summarized based on their temporal or thermal correlations. Because data are so important in ML / DL methods, we describe some of the commonly used network datasets used in ML / DL, discuss the challenges of using ML / DL for cyber security and provide suggestions for research directions.

KEYWORDS:

Machine learning (ML) and deep learning (DL), cyber security, Intrusion Detection Systems.

MULTI-MODAL CNN BASED STROKE DETECTION FROM CT IMAGES AND CLINICAL DATA

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ABSTRACT:

In this survey, we present a comparative analysis of machine learning algorithms used in predictive modeling, with a specific focus on stroke detection. While existing stroke detection models predominantly rely on neuro imaging data, they often overlook critical clinical factors that influence diagnosis. This research addresses that gap by integrating CT scan images and patient-specific clinical data to enhance prediction accuracy. A Convolutional Neural Network (CNN) is employed to extract deep features from CT images, while complementary clinical models are developed using machine learning algorithms such as Logistic Regression (LR), Random Forest (RF), Light Gradient Boosting Machine (LGBM), and Multi-Layer Perceptron (MLP). These models utilize selected clinical variables, including blood pressure, BMI, and age. By combining image-based and clinical features, the proposed hybrid model demonstrates superior performance compared to traditional CNN-only approaches, offering a more comprehensive and accurate method for stroke prediction.

KEYWORDS:

Convolutional Neural Network (CNN), Logistic Regression (LR), Random Forest (RF), Light Gradient Boosting Machine (LGBM), Multi Layer Perceptron (MLP), Clinical Data Integration, CT Scan, Stroke Prediction, Modified Rankin Scale (mRS), Feature Fusion, Predictive Modeling Accuracy.

CLOUD-POWERED AI PLATFORM FOR VULNERABILITY DETECTION IN OPEN-SOURCE SOFTWARE

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ABSTRACT:

Open-source software is used everywhere, but keeping it secure is a big challenge. Many projects don't have dedicated security teams, so finding and fixing vulnerabilities takes too long. Current tools can spot some problems but don't offer automatic solutions, leaving developers to fix issues manually, which slows things down. This problem grows as open-source projects get bigger and more complex. We propose a cloud-based AI platform that uses advanced machine learning to find vulnerabilities and create fixes instantly. The system analyzes code like a language, spotting patterns that older tools miss. It's trained on huge datasets of open-source code, getting better at finding issues over time. For fixes, it uses a smart system that suggests solutions and checks if they're safe. It also learns from past fixes to improve future ones. The platform works across different programming languages and runs in the cloud, so it can handle large projects quickly. Developers can access it easily through web tools or APIs, making it simple to use, even for small teams without powerful computers. This solution aims to make open-source software safer by reducing manual work, speeding up fixes, and strengthening security for everyone.

KEYWORDS:

Cloud Security, Vulnerability Detection, Machine Learning, Code Analysis, Automated Fixes, Open-Source Software, AI Security Tools.

OPTIMIZING EDGE COMPUTING WITH VOLUNTEER RESOURCES: A HYBRID APPROACH TO FOG AND VOLUNTEER COMPUTING

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ABSTRACT:

A comprehensive alternative to the centralized cloud architecture is fog computing, or FC. Users can access an FC node that is located closer to them and extends cloud services in a highly dispersed manner to the network's edge in a way. But with more people streaming and waiting around FC further requires delicate Internet of Things (IoT) applications to solve the problem of increased latency when forwarding computation demanding tasks to distant cloud data centres. Thus, there's a requirement to look into how computing resources are being used at the edge of the system. Volunteer Computing, or VC, provides a decrease in the price of utilizing high-performance computing to sustain of personally owned, unused, or idle resources, such as computers and desktop computers nearer to fogging apparatuses.

KEYWORDS:

Internet Of Things (IOT), Fog Computing, Cloud Architecture, Latency, Volunteer Computing.

NAMED ENTITY RECOGNITION IN LEGAL AND MEDICAL DOCUMENTS USING BERT VARIANTS

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ABSTRACT:

In today's digital age, legal and medical institutions face a significant challenge: they are overwhelmed with unstructured textual data that contains vital information for making decisions, ensuring compliance and providing patience care. This research addresses the challenge of extracting actionable information from unstructured textual data in legal and medical fields, which is complicated by specialized terminology and ambiguity. We explore Named Entity Recognition (NER) using domain-specific BERT variants—Bio BERT, Clinical BERT, and Legal-BERT—assessing their ability to identify high-value entities. Our approach recognizes these domains as unique linguistic environments requiring tailored strategies. Our findings reveal that models designed with domain knowledge consistently outperform more generic models, not just in terms of accuracy but also in their ability to maintain the subtle meanings that are crucial for applications like clinical decision support and legal document automation. The results show that domain-aware models significantly outperform generic ones in both accuracy and contextual nuance. This work lays the foundation for next-generation NER systems that effectively bridge deep language models with domain specificity.

KEYWORDS:

Named Entity Recognition (NER), Domain-Specific BERT , Clinical BERT , Natural Language Processing (NLP) , Medical Text Analysis

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978-93-342-9519-1