

17th & 18th
April 2026

**INTERNATIONAL
CONFERENCE ON
EMERGING TRENDS IN
SCIENCE, TECHNOLOGY,
ENGINEERING & MANAGEMENT '26**

ICESTEM



**Bharath Niketan
Engineering College**

Sri Gowri Nagar, Thimmarasanaickanoor, Aundipatty, Theni – 625 536

International Conference on
**EMERGING TRENDS IN SCIENCE, TECHNOLOGY,
ENGINEERING & MANAGEMENT**

ICESTEM'26

17th & 18th April 2026

Editors

Dr. K. Pounraj

Dr. J. Vivek



BHARATH NIKETAN ENGINEERING COLLEGE

Sri Gowri Nagar, Thimmarasanaickanoor

Aundipatty – 625 536 – Theni

www.bnec.ac.in

Title: INTERNATIONAL CONFERENCE ON EMERGING
TRENDS IN SCIENCE, TECHNOLOGY, ENGINEERING
& MANAGEMENT '26

Editor's Name: Dr. K. Pounraj
Dr. J. Vivek

Published by: Shanlax Publications
61, 66 T.P.K. Main Road,
Vasanthanagar, Madurai – 625003,
Tamil Nadu, India

Printer's Details: Shanlax Press
66 T.P.K. Main Road,
Vasanthanagar, Madurai – 625003,
Tamil Nadu, India

Edition Details (I,II,III): I

ISBN: 978-93-6163-989-0

Month & Year: April, 2026

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Pages: 364

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MESSAGE



Dr. S. Mohan
Managing Chairman

Greetings to all,

I would like to take this opportunity to express my gratitude to the faculty team of our college and I appreciate all HoDs for the dedication and efforts you have put in to make this International conference a reality.

Engineering has always played a critical role in shaping the world we live in. I'm sure that ICESTEM'26 will serve as a platform for researchers and engineers to share their latest research findings and experiences with the broader community.

I extend my congratulations to all the participants who have contributed to this conference. Your research work will undoubtedly make a valuable contribution to the field of engineering and will serve as an inspiration to future generations of engineers.

I would also like to acknowledge and appreciate the organizers of this conference for their unwavering commitment and hard work towards ensuring the success of this event. Without their tireless efforts, this conference would not have been possible.

I wish you all the best in your future endeavors and look forward to seeing the impact of your research on the field of engineering.

Thank you.

MESSAGE



Dr. P.V. Arul Kumar
Principal

Dear all,

It is my pleasure to announce that the proceedings for the Engineering and Technology International Conference are now available.

I want to express my gratitude to all of the presenters, panellists, and attendees who made this conference a success. Your dedication to the advancement of engineering and technology is inspiring, and I am confident that the ideas and insights shared at this conference will have a lasting impact on our field.

I encourage you all to take the time to review the proceedings and continue the conversations sparked by the conference. Let us use this knowledge to drive progress, innovate solutions, and create a better future for all.

Thank you again for your participation, and I look forward to seeing you at the next Engineering and Technology International Conference.



Dr. Muluken Zegeye GETIE

*Deputy Scientific Director for Research & Technology Transfer
Bahir Dar Institute of Technology
Bahir Dar University, Ethiopia*

It is my pleasure to address all of you as a guest speaker for this International conference - ICESTEM'26.

This conference provides an excellent opportunity for all of us to come together and share our knowledge and experiences. The various presentations and discussions during this conference will help us to gain a deeper understanding of the latest technological advancements and their applications in different fields.

As we move forward, it is essential that we continue to collaborate and innovate. Our collective efforts will help us to overcome the challenges we face and pave the way for a better tomorrow. Let us make the most of this conference by engaging in meaningful discussions, sharing our knowledge and experiences, and learning from each other.

Let me congratulate the Management, Principal, Staff and student organizers of the two day International conference.

I wish you all a productive and enlightening conference.

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**DEPARTMENT OF
CIVIL ENGINEERING**

SPACE WEATHER EFFECTS OF THE MAY 2024 GEOMAGNETIC SUPERSTORM

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ABSTRACT

This study investigates the space weather effects of the May10-15, 2024 geomagnetic superstorm, the most intense event observed in the past two decades. The storm reached extreme (G5) classification, with a minimum Dst index of -412 nT and a peak Kp index of 9, making it one of the strongest geomagnetic disturbances of the space era. Occurring during Solar Cycle 25, the event was driven by successive coronal mass ejection (CME) driven shocks impacting Earth, resulting in a prolonged and complex geomagnetic response. The storm led to significant compression of the Earth's magnetosphere and the formation of transient radiation belts, along with a substantial shrinkage of the plasmasphere. In the ionosphere and thermosphere, pronounced disturbances were observed, including intensification of the equatorial ionization anomaly, development of storm-enhanced density structures, and considerable variations in thermospheric density. These space weather effects caused widespread technological impacts. High-frequency (HF) radio communications experienced significant disruptions, while Global Navigation Satellite System (GNSS) signals showed notable positioning errors. Satellite communication systems were also affected, and increased atmospheric drag influenced the orbital dynamics of low-Earth orbit (LEO) satellites. Overall, this event highlights the strong coupling between solar activity and Earth's near-space environment, demonstrating the significant impacts of extreme geomagnetic storms on both space-based and ground-based technological systems.

Keywords: Coronal Mass Ejection, Space Weather, Solar Cycle 25, Dst, Superstorm.

EXPERIMENTAL INVESTIGATION OF ECO FRIENDLY ACC BLOCKS USING SEAWEED

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ABSTARCT

The demand for building materials is growing exponentially as development activities increase worldwide. Green building materials play an important role in sustainable construction. Seaweed is a purely natural substance that has many advantages natural material that offers numerous advantages such as thermal insulation, biodegradability, and strong carbon fixation. The study is carried out on the seaweed species. Seaweed mainly contains Agarose and Agaropectin. This causes strong gelling and thickening properties, which helps a better bonding mechanism. In this study, we investigated the partial replacement of cement with seaweed powder in M25 concrete at percentages of 10%. The study concluded that replacing seaweed with cement at an optimal dose of 10 percent showed an increase in compressive and tensile strength compared to conventional concrete.

Keywords: ACC block, sea weed, Agarose, Concrete, Carbon Fixation, Cement, Sustainable

EFFECT OF NANOPARTICLES SYNTHESISED FROM *Musa sAcuminata* ON IMPROVING SHELF LIFE OF FRUITS

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ABSTARCT

This study was aimed about the synthesized silver nanoparticles using red banana peel aqueous extract derived from the *Musa acuminata* variety. The synthesized silver nanoparticles were characterized using UV and SEM. The evaluation of silver nanoparticles efficacy in prolonging the shelf-life of *Malus domestica*, *Musa balbisiana*, *Lycopersicon esculentum*, *Capsicum annuum* was carried out. Organoleptic quality index are identified for the fruits and vegetables. The results suggested that control specimen and test specimen differs in all the above set parameters. Ultimately, this study holds implications for both environmental sustainability and food preservation techniques, aligning with current efforts towards a more resource-efficient and resilient agri-food system

Keywords: Silver nano particles, *Musa acuminata*, Shelf-life, Environmental sustainability.

IoT BASED FLOOR CLEANING MACHINE

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ABSTARCT

Cleaning large floor areas such as hospitals, shopping malls, railway stations, colleges, and industrial buildings is a time-consuming and labor-intensive task. Traditional manual cleaning methods require more manpower and time, and they may not always provide efficient cleaning results. To overcome these limitations, an efficient and automated cleaning system is necessary. The aim of this project is to design and develop an IoT Based Hybrid Floor Cleaning Machine that can perform both dry and wet cleaning operations effectively while reducing human effort. The proposed system integrates mechanical cleaning mechanisms with modern Internet of Things (IoT) technology to improve cleaning efficiency and monitoring capability. The IoT module enables monitoring and control of the machine through a connected system, making it more intelligent and efficient. In addition to the cleaning performance, the proposed system focuses on providing a user-friendly and energy-efficient solution. The use of a rechargeable battery ensures portability and reduces dependency on external power sources. The integration of IoT technology through a mobile application enhances the usability of the system by allowing remote control and monitoring. This makes the cleaning process more flexible and convenient for users.

Keywords: *IoT, Hybrid Flooring, Mobile Application.*

AI – DRIVEN CROP MANAGEMENT

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ABSTARCT

Agriculture is the one of the most difficult domains, because of the uncertainty introduced by the weather, resource management and variability in soil. This article presents a machine learning driven web application design to provide predictive insights in farming to empower farmers. Users enter information such as location, soil type, and land area, and the system produces tailored weather forecasts, crop suggestions, and financial estimates. Utilizing cutting-edge machine learning technology, the app recognizes future weather trends and recommends crops best suited for the soil and projected conditions. There is also a build-in chatbot that gives advice on crop choice and cultivation timelines and cost-profit analysis, so it's simple, for both experienced and newer farmers, to take a call. Piloting of this methodology indicates it can enhance yield potential minimize risks, and contribute to sustainable farming approaches. The aim is to use AI to improve agricultural productivity, resources efficiency and data-driven decision-making in the field the future of precision farming.

Keywords: *AI-Driven farming, Machine Learning in Agricultural, Crop Prediction, Weather Forecasting, Agricultural Decision Support, Sustainable Farming, Resources Management, Crop Recommendation System, Financial Forecasting in Agriculture, Chatbot for Agriculture.*

**COMPUTER SCIENCE &
ENGINEERING**

CNN –BASED OBJECT RECOGNITION AND TRACKING SYSTEM TO ASSIST VISUALLY IMPAIRED PEOPLE

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ABSTRACT

Proposed object detection and recognition system focuses on improving accuracy, speed, and robustness by implementing the advanced YOLO (You Only Look Once) model. Unlike traditional CNN-based approaches used in Phase 1, YOLO performs detection and classification in a single forward pass, enabling real-time object identification with significantly higher efficiency. This phase emphasizes precise object localization through bounding box prediction along with accurate classification, ensuring better performance in complex and dynamic environments. The model is optimized to handle challenges such as background noise, varying lighting conditions, scale variations, and partial occlusions. By leveraging the hierarchical feature extraction capabilities of deep learning, the system achieves improved precision and recall across diverse datasets. Extensive experimentation and evaluation are conducted to fine-tune hyper parameters, improve generalization, and enhance detection stability in real-world scenarios. Comparative analysis demonstrates that the YOLO-based approach outperforms conventional CNN-influenced object detection models in both speed and detection accuracy. Overall, this transforms the system into a high-performance, real-time object detection solution capable of robust and efficient visual recognition. The enhanced architecture represents a significant advancement toward building an accurate and reliable computer vision system for practical real-world applications.

Keywords: *YOLO, Leveraging, Conventional, Bounding.*

DESIGN AND DEVELOPMENT OF AN INTEGRATED ERP AND AI-ASSISTED VISUALIZATION SYSTEM FOR THE TILES INDUSTRY

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ABSTRACT

Tile Soft is an integrated Enterprise Resource Planning (ERP) system enhanced with an AI-assisted 3D visualization module, developed to address the operational and customer engagement challenges of the Indian tiles industry. Traditional practices in this domain—manual invoicing with error-prone GST calculations, fragmented inventory management, and limited digital tools—create inefficiencies and compliance risks. TileSoft provides a unified, cloud-deployed solution built on the PERN stack (PostgreSQL, Express.js, React.js, Node.js), hosted on Railway with GitHub-enabled Continuous Integration and Deployment. The system incorporates eight functional modules: product catalog management with tile-specific attributes (HSN code 6908, category, color, size), customer and supplier relationship management, automated GST-compliant invoicing (28% GST: 14% CGST + 14% SGST), real-time inventory updates via atomic transactions, employee attendance and payroll, and GSTR-1 reporting in four formats (Summary, Monthly, HSN-wise, B2C). A key innovation is the AI-assisted 3D Room Visualizer, powered by Three.js and WebGL, which enables customers to preview tiles as photorealistic textures in interactive room models—mitigating purchase uncertainty inherent in showroom samples. Comprehensive testing—including authentication, API integration, GST accuracy, and responsive design—resulted in the resolution of thirteen critical issues. The deployed system is fully operational, supporting 40 tile products, 13 customers, 10 employees, and complete invoice and GST records for the 2026 financial year. Tile Soft demonstrates how ERP integration with AI-driven visualization can eliminate billing errors, automate GST compliance, and deliver a professional digital platform that enhances both operational efficiency and customer experience in the tiles industry.

Keywords: ERP, Tiles Industry, PERN Stack, GST Automation, HSN 6908, GSTR-1, 3D Room Visualizer, WebGL, JWT Authentication, Inventory Management, Cloud Deployment, CI/CD.

FINGERPRINT-BASED BLOOD GROUP DETECTION SYSTEM BY USING HYBRID VGG19-RESNET

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ABSTRACT

In this Paper, the fingerprint-based blood group detection system is enhanced using a hybrid deep learning architecture combining VGG19 and ResNet models for improved feature extraction and classification accuracy. The system begins with preprocessing techniques such as normalization, contrast enhancement, and noise reduction to ensure high-quality fingerprint images. VGG19 is employed to extract detailed spatial and ridge-based features, while ResNet's residual connections capture deep hierarchical patterns and mitigate the vanishing gradient problem, allowing the model to learn complex correlations between fingerprint textures and blood groups. The extracted features from both networks are fused and fed into a fully connected layer for classification, enabling robust prediction across all blood group types. Data augmentation techniques, including rotation, scaling, and translation, improve the model's generalization under varied fingerprint orientations. Advanced evaluation metrics such as accuracy, precision, recall, F1-score, and ROC-AUC are used to validate the system's performance. The hybrid VGG19-ResNet framework demonstrates significant improvement over traditional CNN-Random Forest approaches, providing reliable, non-invasive, and fast blood group prediction. This approach has strong potential applications in healthcare diagnostics, forensic investigations, and biometric identification systems, offering a scalable solution for real-time, accurate blood group detection from fingerprints.

Keywords: Fingerprint, blood group, hybrid VGG19-ResNet, accuracy, precision, recall, F1-score, and ROC-AUC

EDGE COMPUTING AND BIG DATA

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ABSTRACT

The rapid expansion of digital technologies, including smart phones, sensors, and connected devices, has resulted in an unprecedented increase in data generation, commonly referred to as Big Data. This data is characterized by high volume, velocity, and variety, making it challenging to store, process, and analyze using traditional cloud-based systems. Although cloud computing provides scalable resources, it often suffers from issues such as high latency, network congestion, increased bandwidth usage, and potential security vulnerabilities when handling real-time data. Edge Computing has emerged as a transformative paradigm that addresses these limitations by processing data closer to the source, such as IoT devices, gateways, and local servers. By reducing the distance between data generation and computation, Edge Computing minimizes latency and enables faster response times. When integrated with Big Data analytics, it allows efficient data filtering, preprocessing, and real-time decision-making before sending only relevant data to the cloud for deeper analysis and storage. In conclusion, the integration of Edge Computing and Big Data enables faster, smarter, and more secure data-driven applications, making it a key technology for future digital transformation.

Keywords: Edge Computing, Big Data, Cloud Computing, IoT, Real-Time Processing, Data Analytics, Low Latency, Data Security, Distributed Systems.

DEVELOPMENT AND IMPLEMENTATION OF DRONE TECHNOLOGY USING ADVANCED SOFTWARE SYSTEMS

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ABSTRACT

The study explores the development and implementation of drone technology, also known as Unmanned Aerial Vehicles (UAVs), with a focus on software systems, operational models, and real-world applications. Drone technology has emerged as a significant innovation in modern engineering, integrating advanced hardware components with intelligent software to perform autonomous and remote-controlled operations. Drones operate through a combination of embedded systems, sensors, communication modules, and flight control algorithms. The core software architecture includes flight control software such as ArduPilot and PX4, which manage stabilization, navigation, and control of the drone. Ground Control Systems (GCS) like Mission Planner and QGroundControl enable users to monitor and control drone operations from remote devices. Additionally, navigation and path-planning algorithms use GPS and real-time data processing to ensure accurate movement and obstacle avoidance. Advanced technologies such as Artificial Intelligence (AI), Internet of Things (IoT), and computer vision are integrated into drone systems to enhance automation, object detection, and data analysis. Despite their advantages, drone systems face challenges such as limited battery life, security risks, regulatory restrictions, and privacy concerns. However, continuous advancements in software and communication technologies are improving drone capabilities and expanding their applications in fields such as agriculture, disaster management, delivery services, and defense. The findings of this study highlight the importance of integrating software and hardware systems in drone technology to achieve efficient, reliable, and intelligent aerial operations, thereby contributing to future technological advancements.

Keywords: Drone Technology, UAV, Flight Control Software, ArduPilot, PX4, Artificial Intelligence, IoT, Multi-rotor, Fixed-wing, Simulation Software, Autonomous Systems.

SECURE DATA TRANSMISSION OVER NETWORKS USING SYMMETRIC ENCRYPTION AND TLS

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ABSTRACT

Secure data transfer across networks has become essential in today's digital world due to ongoing risks such as eavesdropping, data tampering, and man-in-the-middle attacks. This paper examines the use of symmetric encryption techniques within the framework of the Transport Layer Security protocol, specifically utilizing the Advanced Encryption Standard algorithm to ensure data confidentiality, integrity, and authentication in environments with limited security. The study introduces the fundamentals of symmetric encryption, where a shared secret key is used for both encryption and decryption, making it highly efficient for high-speed data transmission. Furthermore, TLS is discussed as a layered security protocol that employs symmetric encryption for bulk data transfer after establishing a secure session through asymmetric key exchange and certificate-based authentication. An experimental model is proposed to evaluate the performance of this hybrid approach. The results demonstrate that integrating symmetric encryption within TLS significantly reduces communication latency and computational overhead compared to methods relying solely on asymmetric cryptography, while still maintaining strong security standards. Overall, the findings highlight the practical effectiveness of symmetric encryption in TLS, making it suitable for real-world applications such as web communications and Internet of Things (IoT) systems.

Keywords: *Cyber security, Network Security, Cryptography, Symmetric Encryption, Transport Layer Security (TLS), Advanced Encryption Standard (AES), Secure Data Transmission, Data Confidentiality, Data Integrity, Authentication, Internet of Things*

NEUROLENS: A DEEP LEARNING PARADIGM FOR EARLY COGNITIVE DISORDER DETECTION AND IMAGE UNDERSTANDING

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ABSTRACT

The increasing prevalence of neuro cognitive disorders among the elderly population presents significant challenges to healthcare systems worldwide. Early detection of cognitive impairments is essential for improving patient outcomes through timely intervention and effective management. This project proposes a deep learning-based approach that utilizes routine medical check-up data to identify early signs of neuro cognitive disorders. By analyzing various health metrics, the system aims to deliver a reliable, scalable, and accurate method for detecting cognitive decline, thereby enhancing traditional diagnostic procedures and supporting healthcare professionals in continuous patient monitoring. In addition, the project incorporates an image recognition module using Convolutional Neural Networks (CNNs) to address challenges in object detection and classification within large image datasets. Image classification, while intuitive for humans, remains a complex task for machines due to variations in patterns and features. The proposed model focuses on accurately identifying and categorizing objects within images into predefined classes, ensuring efficient and precise classification. The integration of deep learning techniques for both medical data analysis and image recognition improves overall system performance and applicability. This approach finds relevance in multiple domains such as healthcare diagnostics, autonomous vehicle navigation, robotics, and remote sensing. Ultimately, the system aims to provide a robust, efficient, and intelligent solution for early disease detection and advanced image classification tasks.

Keywords: *Neurocognitive Disorders, Early Detection, Deep Learning, Convolutional Neural Networks (CNN), Healthcare Analytics, Image Classification, Predictive Modelling, Clinical Decision Support System, Computer Vision, Elderly Healthcare.*

ARTIFICIAL INTELLIGENCE, MACHINE LEARNING AND DATA SCIENCE FOR SMART APPLICATIONS

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ABSTRACT

Artificial Intelligence (AI), Machine Learning (ML), and Data Science (DS) are rapidly growing technologies that are transforming the modern world through intelligent systems and data-driven solutions. These fields are interconnected and play a vital role in developing applications that can analyse data, learn from patterns, and make accurate decisions with minimal human intervention. AI focuses on creating machines that can simulate human intelligence, while Machine Learning enables systems to learn automatically from data and improve their performance over time. Data Science, on the other hand, deals with collecting, processing, and analysing large volumes of data to extract meaningful insights. In this project, an integrated system is proposed that utilizes AI, ML, and Data Science techniques to build smart and efficient applications. The system collects data from multiple sources and processes it using data cleaning, transformation, and visualization methods. Machine AI techniques are used to automate decision-making processes and improve system efficiency. The system also supports real-time data analysis, allowing quick responses and better adaptability to changing conditions. This approach can be applied in various domains such as healthcare for disease prediction, finance for fraud detection, education for personalized learning, and business for customer behaviour analysis. The main objective of this project is to demonstrate how the combination of Artificial Intelligence, Machine Learning, and Data Science can be used to develop intelligent systems that enhance productivity, reduce human effort, and support better decision-making. These technologies are shaping the future by enabling automation and innovation across multiple industries, making them essential for students and professionals in the digital era.

Keywords: Artificial Intelligence, Machine Learning, Data Science, Predictive Analytics, Intelligent Systems, Data Processing, Automation, Pattern Recognition, Real-Time Analysis, Decision Making.

DRIVER DROWSINESS DETECTION USING COMPUTER VISION AND MACHINE LEARNING

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ABSTRACT

Driver drowsiness is a major cause of road accidents, leading to serious injuries and loss of life. This paper presents an AI-based driver drowsiness detection system that monitors the driver's alertness in real time using computer vision. The system uses a webcam to capture video frames and applies Haar Cascade classifiers to detect the face and eyes. By analyzing eye closure over consecutive frames, it identifies signs of fatigue. A threshold-based method is used to detect prolonged eye closure, a key indicator of drowsiness. When detected, the system triggers an audio alert and displays a visual warning to notify the driver and help prevent accidents. The system is simple, cost-effective, and does not require specialized hardware, making it suitable for real-time use. Experimental results show reliable performance under normal lighting conditions. The system can be further improved by integrating deep learning techniques and additional parameters to enhance accuracy under different environmental conditions.

Keywords: *Driver Drowsiness Detection, Computer Vision, Haar Cascade Classifier, Eye Detection, Real-Time Monitoring, Artificial Intelligence, Road Safety.*

SMART CAMPUS ENQUIRY SYSTEM ASSISTANCE USING AI

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ABSTRACT

The “Smart Campus Enquiry System Assistance Using AI,” specifically developed for Mangayarkarasi College of Engineering (MCE) in Madurai, represents a significant paradigm shift in how educational institutions manage their digital ecosystems and engage with their diverse stakeholders. Conventional campus management systems often suffer from fragmented architectures, leading to “data silos” and communication gaps that frustrate students, faculty, parents, and administrators alike. This project directly addresses these systemic challenges by integrating a high-performance web-based management platform with a state-of-the-art AI-driven enquiry assistant. The technical foundation of the MCE Smart Campus system is built upon a modern, scalable technology stack. The frontend leverages React 19, Vite, and TypeScript to provide a lightning-fast, type-safe, and highly responsive user interface. For the backend, the system utilizes Supabase, a Firebase alternative built on top of PostgreSQL, which provides real-time database capabilities, robust authentication, and secure storage through Row Level Security (RLS) policies. The centerpiece of the system’s innovation is its AI Chatbot, powered by the Groq SDK and utilizing the advanced Llama 3.3-70b-versatile Large Language Model (LLM). Unlike generic chatbots, this assistant is meticulously fine-tuned with MCE-specific institutional data, including detailed department profiles, exceptional placement records (95% placement rate, 12 LPA highest package), and complex administrative procedures. AI-powered interface, the MCE Smart Campus system not only enhances operational efficiency, transparency, and the overall campus experience, but it also provides a framework for future AI-driven institutional growth. This documentation provides a comprehensive deep-dive into the design methodology, technical implementation, and the transformative potential of AI in shaping the future of higher education management.

Keywords: *Smart Campus System, AI Enquiry Assistant, Educational Technology, Campus Management System, Chatbot, Large Language Model, Llama 3, Groq SDK*

VEHICLE DETECTION USING CONVOLUTIONAL NEURAL NETWORKS

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ABSTRACT

The UAV-based vehicle detection system is enhanced using CNN-2D architectures and the VGG19 deep learning model for feature extraction, combined with YOLOv8 for precise vehicle detection. 2D convolutional layers in VGG19 effectively capture detailed spatial features from aerial imagery, enabling better recognition of small and densely packed vehicles. The system incorporates advanced prediction features such as vehicle type classification, speed estimation, and trajectory prediction in real-time video streams. Data augmentation methods, including rotation, scaling, flipping, and brightness adjustments, improve model robustness under varying environmental conditions. The YOLOv8 detection module provides high-speed localization with bounding boxes and confidence scores, while an integrated attention mechanism emphasizes salient vehicle regions to reduce background noise. Transfer learning with pre-trained VGG19 weights and CNN-2D feature maps accelerates convergence and enhances generalization across different UAV datasets. Additionally, a multi-frame tracking algorithm ensures accurate vehicle identity maintenance across consecutive frames. The system also supports automated alert generation for traffic congestion, illegal parking, or abnormal vehicle behavior. Quantitative evaluation using precision, recall, F1-score, and mean Average Precision (mAP) demonstrates substantial improvement over conventional approaches. This combined framework of CNN-2D feature extraction, VGG19-based deep learning, YOLOv8 detection, and predictive analytics offers a scalable, reliable, and efficient solution for real-time vehicle monitoring, traffic management, and intelligent transportation applications from UAV imagery.

Keywords: YOLOv8, Flipping, UAV imagery

SATELLITE COMMUNICATION

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ABSTRACT

The study focuses on satellite communication systems and their importance in modern communication networks. Satellite communication enables the transmission of voice, data, and video signals over long distances using artificial satellites, making global connectivity possible. It is widely used in applications such as television broadcasting, internet services, navigation, and weather forecasting. This research aims to understand the basic working principles and performance of satellites communication systems. The study includes an analysis of key components such as satellites, transponders, and ground stations, along with the process of signal transmission through uplink and downlink. Important factors affecting communication quality, including signal attenuation, noise, and propagation delay, are also examined. In addition, different satellite orbits and their roles in communication are briefly discussed. The findings help in understanding how to improve signal quality, increase efficiency, and ensure reliable communication. Overall, satellite communication plays a vital role in connecting different parts of the world and supporting modern technological developments.

Keywords: *Satellite Communication, Uplink, Downlink, Transponders, Ground Stations, Signal Attenuation, Latency, Communication Systems.*

RECENT TRENDS IN INFORMATION TECHNOLOGY

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ABSTRACT

In recent years, Information Technology (IT) has evolved rapidly with the development of advanced digital technologies. Emerging innovations such as Artificial Intelligence (AI), Agentic AI, Cloud Computing, the Internet of Things (IoT), and Data Analytics are transforming the way organizations operate and deliver services. These technologies enable intelligent automation, real-time data processing, and the development of secure and scalable digital systems. In addition, hybrid cloud architectures and advanced cybersecurity strategies help organizations manage and protect large volumes of data efficiently. The adoption of modern IT trends allows businesses to improve productivity, enhance decision-making, and deliver better user experiences. Furthermore, the integration of intelligent systems and data-driven technologies supports digital transformation across various industries. As technology continues to advance, IT will play a vital role in building intelligent, connected, and secure digital ecosystems for the future.

Keywords: *Artificial Intelligence (AI), Agentic AI, Cloud Computing, Internet of Things (IoT), Data Analytics, Cybersecurity, Automation, Hybrid Cloud, Digital Transformation.*

CROP DISEASE DETECTION VIA MOBILE APP USING YOLOV8

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ABSTRACT

Agriculture is essential for feeding the world's population, yet crop diseases continue to be a major factor limiting agricultural productivity. Early identification of these diseases is crucial to prevent yield losses, minimize excessive pesticide usage, and encourage sustainable farming practices. Conventional approaches, such as manual field inspection by experts, are often slow, labor-intensive, and susceptible to human error, particularly in resource-constrained regions like certain parts of Africa. Recent developments in Artificial Intelligence and deep learning have enabled automated detection of plant diseases through image analysis. This study introduces a real-time crop disease detection system implemented as a mobile application, utilizing the YOLOv8 model. YOLOv8 is selected due to its superior speed and accuracy, making it ideal for deployment in mobile and edge-based environments. The application processes images of plant leaves either captured in real time or uploaded by users, detects diseased areas, and delivers immediate diagnostic feedback along with recommended treatments. To enhance robustness across diverse environmental and lighting conditions, the model is trained on a wide range of crops and disease classes. In summary, the proposed solution offers a strong combination of accuracy, speed, and low computational requirements, making it highly suitable for real-time use on edge devices. This approach contributes to the development of smart agriculture by providing an accessible, AI-powered tool for effective disease detection and better crop management.

Keywords: Crop Disease Detection, Agriculture, Artificial Intelligence, Deep Learning, YOLOv8, Mobile Application, Image Processing, Plant Leaves, Real-Time Detection, Smart Farming, Disease Identification, Sustainable Agriculture.

EXPLAINABLE ANDROID MALWARE ANALYSIS USING GEMMA

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ABSTRACT

The rapid growth of Android applications has significantly increased the risk of malware attacks, creating a strong need for effective and reliable security solutions. This project introduces an explainable Android malware analysis system using static analysis techniques. The system examines application files without execution, analyzing features such as permissions, API calls, and manifest data to detect malicious behaviour. It utilizes the Gemma model, a lightweight and efficient machine learning model, to classify applications as benign or malicious. To enhance transparency, the system integrates Explainable Artificial Intelligence (XAI) techniques, providing clear insights into the decision-making process. This helps users and security analysts understand why an application is identified as malware. The model is trained and tested on real-world datasets, achieving high accuracy in malware detection while maintaining low computational complexity. Overall, the system reduces security risks, improves detection efficiency, and provides an intelligent and trustworthy solution for Android malware analysis.

Keywords: *Artificial Intelligence, Machine Learning, Static Analysis, Android Malware, Explainable AI, Gemma Model, APK Analysis, Permission Analysis, API Call Analysis.*

6G AI SECURITY: FROM FUNDAMENTALS TO OFFENSIVE AND DEFENSIVE LANDSCAPE IN 6G

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ABSTRACT

The sixth generation (6G) of mobile networks presents transformative possibilities but also introduces significant security challenges. This paper surveys the state-of-the-art in 6G security from 2020 to 2025, highlighting advancements, challenges, and potential solutions. We distinguish our survey by offering a comprehensive, cross-layer analysis of the role of artificial intelligence (AI) in both enabling and threatening 6G security. First, we outline the technological foundations and core features of 6G and 6G AI, emphasizing their implications for security. We then explore how AI can be leveraged for both offensive and defensive purposes across the infrastructure, network service, and application layers. Our study categorizes AI-driven threats and countermeasures and provides a structured analysis of five key security frameworks. We further examine how quantum-enhanced technologies contribute to securing AI in 6G environments. Finally, we identify open research questions and present key lessons learned to guide future research in building resilient and trustworthy AI-integrated 6G networks.

Keywords: *Cross-layer analysis, 6G security, Emphasizing.*

GREEN GUARDIAN: COMMUNITY-DRIVEN URBAN ENVIRONMENTAL HAZARD REPORTER

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ABSTRACT

Green Guardian: Your Community's Eye on a Better Tomorrow focuses on enhancing transparency, collaboration, and data-driven governance across Tamil Nadu. This phase introduces advanced interactive and analytical features that strengthen communication between citizens and local authorities while improving decision-making efficiency. A key enhancement is the Interactive Map View for Reports, which visually displays all reported issues on a dynamic map interface. Users and administrators can easily identify problem locations, detect clusters of recurring issues, and understand geographic patterns at a glance. This spatial visualization improves prioritization and enables faster response planning by municipal teams. It also integrates a Comment System that facilitates two-way communication between users and administrators. Citizens can seek updates or provide additional details, while admins can respond with progress information or request clarification. Additionally, the platform introduces Reports and Analytics, offering graphical dashboards that present key performance indicators such as total issues reported, resolution rates, average resolution time, and frequently affected hotspots. These visual insights support strategic planning, resource allocation, and long-term urban improvement initiatives. Overall, this transforms Green Guardian from a basic reporting system into a smart civic management platform by combining interactive visualization, structured communication, and analytical intelligence to promote efficient and sustainable community governance.

Keywords: *Citizen Reporting, Urban Management, GPS Tracking, Tamil Nadu, Environmental Monitoring, Public Space Maintenance.*

BRAIN TUMOR DETECTION, SEGMENTATION AND CLASSIFICATION USING CNN

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ABSTRACT

Brain tumor detection is a crucial task in medical image analysis, as early diagnosis plays a vital role in improving patient outcomes. Magnetic Resonance Imaging (MRI) is commonly used to detect brain abnormalities due to its high-resolution imaging capability. Traditional methods mainly depend on manual diagnosis and rule-based techniques, which often result in moderate accuracy and consume more time. In this project, a Convolutional Neural Network (CNN)-based model is proposed for tumor detection, segmentation, and classification. The system automatically learns features from MRI images during the training process, eliminating the need for manual feature extraction. The model is trained on labeled datasets to accurately identify tumor regions and classify them into different types. This approach improves detection accuracy and reduces diagnosis time, thereby assisting doctors in making faster and more reliable decisions. The proposed system highlights the effectiveness of deep learning techniques in enhancing medical diagnosis and supporting healthcare applications.

Keywords: Brain Tumor Detection, MRI, CNN, Image Segmentation, Classification, Deep Learning.

ADAPTING FOOD SUPPLY CHAIN TO CLIMATE CHANGE USING SIMULATION MODELS

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ABSTRACT

Supply chain disruptions pose significant risks to global commerce, requiring intelligent systems that can predict vulnerabilities before they escalate. This project develops an integrated risk prediction framework combining machine learning, deep learning, and agent-based modeling to classify supply chain operations into low, medium, or high risk categories. A Random Forest Classifier identifies patterns in historical data, while a Convolutional Neural Network (CNN) captures complex non-linear relationships, and an Agent-Based Model (ABM) simulates the autonomous behavior of suppliers, manufacturers, and consumers. These three approaches are implemented within a Flask-based web application that guides users through data upload, preprocessing, model training, and real-time risk prediction with comparative performance analysis.

Keywords: Agent-Based Model (ABM), Convolutional Neural Network (CNN)

AUTO GRIND PRO USING ESP8266 SMART CONTROL

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ABSTRACT

The rapid advancement of Internet of Things (IoT) technology has significantly influenced the development of modern household and industrial appliances by enabling automation, connectivity, and intelligent control. This project presents the design and implementation of an IoT-based Smart Wet Grinder System, which enhances the traditional grinding process through automation and remote accessibility. The proposed system utilizes an ESP8266 microcontroller to manage and coordinate the operations of the wet grinder motor and the water dispensing mechanism. Users can control the system either manually or remotely through a Wi-Fi-based HTTP interface, providing flexibility and convenience. A relay module is incorporated to ensure safe operation of the high-power grinder motor, while an OLED display provides real-time updates on system status and operational parameters. Additionally, push-button inputs are included to enable local control, ensuring uninterrupted operation even in the absence of internet connectivity. The integration of IoT technology reduces manual intervention, improves energy efficiency, and maintains consistent grinding quality. Overall, this system demonstrates how conventional household appliances can be transformed into smart, connected, and efficient devices using IoT. The proposed solution highlights the potential of IoT in enhancing usability, safety, and performance in everyday applications.

Keywords: *Internet of Things (IoT), Smart Wet Grinder, ESP8266 NodeMCU, Automation, Wi-Fi Control, Embedded Systems, Home Automation, Remote Monitoring.*

FROM CLICKS TO THREATS: MALICIOUS URL DETECTION IN CYBER SECURITY

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ABSTRACT

The rapid expansion of web-based applications has significantly increased exposure to cyber threats, particularly SQL Injection (SQLi) and Cross-Site Scripting (XSS) attacks. This study introduces a comprehensive framework aimed at strengthening web security through the integration of diverse detection strategies for identifying SQLi and XSS vulnerabilities. The proposed system employs automated scanning methods alongside penetration testing tools, including SQLMap for SQL Injection detection and script-driven techniques for XSS analysis. By enabling early identification of security weaknesses, the framework supports security practitioners in preventing potential attacks before they are exploited. The results highlight the critical role of proactive vulnerability assessment in safeguarding modern web applications. This research investigates advanced approaches such as heuristic-based evaluation, machine learning-driven anomaly detection, and behavior-oriented security mechanisms to enhance the precision and effectiveness of threat detection.

Keywords: Malicious URL Detection, Heuristic Analysis, Phishing Prevention, Explainable Security, URL Threat Intelligence. Cyber security,

REAL-TIME FACIAL EXPRESSION RECOGNITION USING DEEP CONVOLUTIONAL NEURAL NETWORK

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ABSTRACT

Facial expression recognition is an important component of modern human-computer interaction, allowing systems to interpret and respond to human emotions in real time. This paper introduces an effective method for real-time facial expression recognition based on Deep Convolutional Neural Networks (DCNNs). The system processes live video streams, detects human faces using efficient algorithms, and categorizes expressions into key emotional states such as happiness, sadness, anger, surprise, fear, and neutral. To achieve strong performance and generalization, the model is trained on a large and diverse facial expression dataset. Various preprocessing steps, including face alignment and normalization, are employed to enhance robustness against changes in lighting conditions and facial pose. The DCNN architecture is carefully designed to maintain a balance between accuracy and computational efficiency, ensuring suitability for real-time deployment. Experimental evaluations show that the system delivers high recognition accuracy with minimal delay. This makes it well-suited for practical applications such as intelligent interfaces, mental health assessment tools, driver monitoring systems, and interactive gaming environments. The results emphasize the effectiveness of deep learning approaches in building adaptive and emotion-aware systems.

Keywords: Facial Expression Recognition, Deep Convolutional Neural Network (DCNN), Real-Time Emotion Detection, Computer Vision, Human-Computer Interaction, Face Detection, Emotion Classification, Deep Learning, Image Preprocessing, Intelligent Systems.

FAKE JOB RECRUITMENT DETECTION USING MACHINE LEARNING APPROACH

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ABSTRACT

This study develops a machine learning framework to detect fraudulent job postings using structured features from recruitment datasets. A dataset comprising numerical and categorical attributes such as salary offered, company years of operation, number of employees, required experience years, number of vacancies, application deadline days, and presence of company logo, email domain validity, and contact information is utilized to train two classification algorithms. Random Forest and XGBoost. Label encoding and one-hot encoding are applied to convert categorical variables into numerical format. Missing value imputation and feature scaling are performed during preprocessing. Model performance is evaluated using train-test split and cross-validation. Both models successfully classify job postings as either Fake or Real based on structural and metadata indicators. Feature importance analysis reveals that unrealistic salary ranges, missing company contact information, invalid email domains, and extremely short application deadlines are the strongest predictors of fake job postings. This framework provides a lightweight screening tool to identify recruitment fraud, making it faster and easier to deploy.

Keywords: Fake Job Detection, Machine Learning, Random Forest, XGBoost, Recruitment Fraud

AN INTELLIGENT MACHINE LEARNING –BASED SYSTEM FOR EARLY DIABETES PREDICTION USING TECHNIQUES

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ABSTRACT

Artificial Intelligence (AI) has emerged as a transformative force in the healthcare sector, enabling early diagnosis and improving patient outcomes through predictive analytics. Diabetes, a chronic metabolic disorder, requires early detection to prevent severe complications such as cardiovascular diseases, kidney failure, and neuropathy. This paper presents an intelligent machine learning-based system for early diabetes prediction using ensemble techniques. The project utilizes the Pima Indians Diabetes dataset, which contains several medical predictor variables including glucose level, body mass index (BMI), insulin, age, and blood pressure. Among the models, the Random Forest classifier demonstrated superior performance due to its ability to handle complex data patterns and reduce overfitting.

The results indicate that ensemble methods provide more reliable predictions compared to individual models. The proposed system can assist healthcare professionals in early-stage diagnosis and decision-making. Future work includes integrating deep learning models and deploying the system as a real-time clinical decision support tool.

Keywords: *Machine Learning, Diabetes Prediction, Healthcare AI, Ensemble Learning, Random Forest, Predictive Analytics.*

BLOCKCHAIN-BASED TRANSPARENCY IN AGRI-FOOD SUPPLY CHAIN

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ABSTRACT

The modern agri-food system faces several challenges related to transparency, product traceability, and fair compensation for farmers, which often leads to low-quality products and lack of reliable origin verification. This project aims to develop a secure and transparent system using Polygon technology to ensure that all transactions are clearly recorded and farmers receive a fair share of profits. By utilizing smart contracts, the system automatically generates permanent and verifiable records that can be tracked throughout the entire supply chain until the product reaches consumers. Polygon enables high scalability and strong security, allowing large-scale supply chain operations without compromising data accuracy. As a result, the system supports regulatory compliance, enhances accountability among stakeholders, and promotes trust and openness within the agri-food ecosystem.

Keywords: *Transparency, traceability, fair farmer payment, secure blockchain (Polygon), smart contracts, digital records, supply chain tracking, scalability, data accuracy, compliance, accountability, and consumer trust.*

SECURE DATA TRANSMISSION OVER NETWORKS USING SYMMETRIC ENCRYPTION AND TLS

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ABSTRACT

Secure data transfer across networks has become essential in today's digital world due to ongoing risks such as eavesdropping, data tampering, and man-in-the-middle attacks. This paper examines the use of symmetric encryption techniques within the framework of the Transport Layer Security protocol, specifically utilizing the Advanced Encryption Standard algorithm to ensure data confidentiality, integrity, and authentication in environments with limited security. This project introduces the fundamentals of symmetric encryption, where a shared secret key is used for both encryption and decryption, making it highly efficient for high-speed data transmission. Furthermore, TLS is discussed as a layered security protocol that employs symmetric encryption for bulk data transfer after establishing a secure session through asymmetric key exchange and certificate-based authentication. An experimental model is proposed to evaluate the performance of this hybrid approach. The results demonstrate that integrating symmetric encryption within TLS significantly reduces communication latency and computational overhead compared to methods relying solely on asymmetric cryptography, while still maintaining strong security standards. Overall, the findings highlight the practical effectiveness of symmetric encryption in TLS, making it suitable for real-world applications such as web communications and Internet of Things (IoT) systems.

Keywords: *Cyber security, Network Security, Cryptography, Symmetric Encryption, Transport Layer Security (TLS), Advanced Encryption Standard (AES), Secure Data, Transmission, Data Confidentiality, Data Integrity, Authentication, Internet of Things (IoT).*

SAFETY GUARDRAILS FOR LLM-ENABLED

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ABSTRACT

The use of large language models (LLMs) in robotics has enabled powerful new capabilities, but it also raises serious safety challenges. These include common issues like hallucinations as well as deliberate adversarial attacks, such as jail breaking, which may cause robots to behave dangerously in real-world environments. Existing robot safety methods fail to account for the context-sensitive weaknesses of LLMs, while current LLM safety techniques do not adequately address the physical risks associated with robotic systems. To tackle these challenges, we introduce Robo Guard, a two-stage safety framework. In the first stage, Robo Guard adapts predefined safety rules to the robot's surroundings using a trusted LLM that is protected from malicious inputs. This model applies chain-of-thought reasoning to produce context-aware safety constraints, including formal representations like temporal logic. In the second stage, Robo Guard evaluates and reconciles any conflicts between these safety constraints and the robot's planned actions through temporal logic-based control synthesis, ensuring safety while preserving user intent as much as possible. Through both simulated and real-world experiments, including scenarios with strong adversarial attacks, Robo Guard decreases unsafe action execution from over 92% to under 3%, without degrading performance on safe tasks. Additionally, the system is computationally efficient, resilient to adaptive threats, and benefits from the reasoning capabilities of its trusted LLM component. These findings highlight Robo Guard's effectiveness in improving the safety and dependability of robots powered by LLMs.

Keywords: *Large Language Models (LLMs), Robot Safety, AI Safety, Embodied AI, Human-Robot Interaction, Hallucination, Adversarial Attacks, Jailbreaking, Prompt Injection, Robots.*

FROM MODEL-CENTRIC TO DATA-CENTRIC: OPTIMIZING PREDICTIVE ACCURACY VIA AGENTIC AI AND SYNTHETIC DATA AUGMENTATION

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ABSTRACT

In the evolving landscape of Artificial Intelligence (AI) and Machine Learning (ML), the traditional model-centric approach focused on refining increasingly complex architectures has reached diminishing returns, particularly when dealing with sparse, noisy, or biased real-world data. This paper proposes a data-centric AI framework that emphasizes systematic improvements in data quality rather than model complexity. We introduce an Agentic Data Science (DS) pipeline that leverages autonomous multi-agent systems to perform real-time data auditing, automated feature engineering, and synthetic data generation using Generative Adversarial Networks (GANs). The proposed framework is evaluated on highly imbalanced datasets from finance and healthcare domains. Experimental results demonstrate that the data-centric approach improves model F1-scores by up to 22% compared to traditional hyper parameter tuning techniques. Additionally, the integration of Explainable AI (XAI) ensures transparency and audit ability of decisions made by autonomous agents. These findings highlight the potential of self-evolving data pipelines capable of adapting to distribution shifts without manual intervention, representing a significant step toward Artificial General Intelligence (AGI) in domain-specific applications.

Keywords: *Agentic AI, Data-Centric Machine Learning, Synthetic Data, Explainable AI, Predictive Analytics.*

SCALING HYBRID QUANTUM-HPC APPLICATIONS WITH THE QUANTUM FRAMEWORK

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ABSTRACT

Hybrid quantum-high performance computing (Q-HPC) workflows are becoming an important approach for executing quantum applications at scale on today's noisy intermediate-scale quantum (NISQ) systems. Such workflows need to function smoothly across a variety of simulators and hardware platforms, as no single simulator delivers optimal performance for all types of quantum circuits. The efficiency of simulation is highly influenced by factors such as circuit depth, structure, and entanglement, making a flexible and backend-independent execution framework crucial for accurate benchmarking, better platform selection, and identifying potential quantum advantage. In this study, we enhance the Quantum Framework (QFw), a modular and HPC-oriented orchestration system, by integrating several local simulation backends (Qiskit Aer, NWQ-Sim, QTensor, and TN-QVM) along with a cloud-based quantum platform (IonQ) through a unified interface. Using this extended framework, we evaluate both variational and non-variational quantum workloads. The results reveal that performance varies depending on the workload: Qiskit Aer's matrix product state method performs well for large Ising model simulations, whereas NWQ-Sim demonstrates strong performance for highly entangled and Hamiltonian-based problems, and also benefits from distributed execution of subproblems in optimization tasks. Overall, these results show that a simulator-independent, HPC-aware orchestration approach provides a practical solution for building scalable, reproducible, and portable Q-HPC environments, thereby supporting faster progress toward achieving quantum advantage.

Keywords: Hybrid quantum computing, HPC, Q-HPC workflows, NISQ devices, quantum simulation, backend-agnostic framework, variational algorithms, distributed computing, and quantum advantage.

STUDENT PERFORMANCE PREDICTION SYSTEM

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ABSTRACT

This project develops a Student Performance Prediction System using machine learning to identify students at risk of poor academic outcomes. The system uses four algorithms Sequential Minimal Optimisation, Extreme Learning Machine, Decision Tree, and Random Forest to analyze student data such as demographics, academic history, family background, and lifestyle factors. By combining these models through a majority voting method, the system achieves higher accuracy than individual models. It is implemented as an interactive Streamlit web application with features for single and batch predictions, as well as data insights and visualization. Students are classified into three categories High, Medium, and Low performance and each prediction includes tailored recommendations to support academic improvement.

Keywords: Machine Learning, Ensemble Learning, Educational Data Mining, Classification, Random Forest, Decision Tree, Extreme Learning Machine, Sequential Minimal Optimisation, Academic Analytics.

ASCINA: EFFICIENT PROOF OF RETRIEVABILITY FOR INDUSTRIAL CLOUD STORAGE SYSTEMS

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ABSTRACT

Industrial cloud storage systems enhance data availability and offer intelligent services to enterprises. However, they also bring significant concerns about data integrity since the cloud space provider may not consistently retain the outsourced data. Existing cloud storage verification methods impose a significant computational burden on edge devices, so they are unsuitable for industrial cloud storage systems. Although the lightweight homomorphic authenticator somewhat alleviates the computational load on the fog node, its effectiveness remains limited and it further complicates proof generation and verification. To address these problems, we propose Ascina, a new proof of retrievability framework for industrial cloud storage systems. We employ verifiable secret sharing to delegate tag computation tasks to the computing server without disclosing the signing key. Once the fog node completes its initial configuration, no further computations are required. Additionally, we propose the improved Ascina by utilizing Fast Fourier Transform (FFT) and Inverse Fast Fourier Transform (IFFT) technology to further alleviate the computational burden on the fog node. Furthermore, we propose a batch verification algorithm that simultaneously validates the integrity of multiple files while maintaining the same security assurances as single auditing. We evaluate the performance of Ascina through experiments and compare it with state-of-the-art methods. Experimental results demonstrate that the computational overhead on the fog node in Ascina is $5 \times 251 \times$ lower than that of Edasvic and our proof verification time and proof size are reduced by $5 \times 16 \times$ and $977 \times 3285 \times$, respectively. As the size and quantity of files grow, Ascina demonstrates greater efficiency in both time and space.

Keywords: *Industrial cloud storage, data integrity, cloud computing, public auditing, batch auditing.*

IMAGE AND VIDEO PROCESSING

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ABSTRACT

Women's safety has become a critical concern in modern society. This project presents a smart CCTV surveillance system using image and video processing techniques to detect and prevent potential threats. The system captures real-time video and analyzes facial expressions, emotions, and body language to identify signs of fear or distress in women. It also monitors surrounding activities to detect suspicious behavior such as unusual movements or close interactions. To reduce false alerts caused by acting or non-threatening situations, the system applies multi-level verification by considering emotion, time duration, motion patterns, and environmental context. Only when all conditions indicate a possible threat, the system generates an alert. The alert includes location details, time, and video evidence, which are automatically sent to the nearest police station for immediate action. This project aims to enhance public safety and support faster response through intelligent surveillance.

Keywords: *Image Processing, Video Processing, CCTV Surveillance, Women Safety, Emotion Detection, Suspicious Activity Detection, Real-Time Monitoring, Computer Vision, Threat Detection, Alert system.*

WIRELESS BODY AREA NETWORK

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ABSTRACT

Wireless Body Area Networks (WBANs) represent an emerging technology designed to enable seamless communication among sensors and devices placed on, in, or around the human body. These networks facilitate continuous health monitoring, real-time diagnostics, and remote medical support, playing a critical role in modern telemedicine and personalized healthcare systems. WBANs consist of lightweight, low-power sensors that collect physiological data such as heart rate, body temperature, blood pressure, and motion patterns. Despite their significant potential, WBANs faces ever all challenges, including energy efficiency, data security, interference management, and reliable communication in dynamic environments. This paper explores the architecture, applications, design challenges, and future directions of WBANs, aiming to provide a comprehensive overview of their role in advancing healthcare technologies.

Keywords: *Wireless Body Area Network (WBAN), Health Monitoring, Biomedical Sensors, Telemedicine, Energy Efficiency, Data Security, Wearable Devices, Sensor Networks, Healthcare IoT, Real-Time Monitoring.*

PHISHING DETECTION IN SEARCH ENGINES WITH SECURE USER AUTHENTICATION AND CHAT-BASED FAKE URL DETECTION

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ABSTRACT

A phishing detection system designed to improve online security while preserving user privacy. It begins by highlighting the growing issue of phishing attacks, which commonly occur through malicious URLs found in search engine results and chat-based communication platforms. To address this problem, the proposed system integrates multiple security mechanisms, including user authentication, search engine URL filtering, and real-time detection of suspicious links shared in chats. Instead of downloading and analyzing full webpage content, the system uses Natural Language Processing (NLP) features to examine the structure and patterns of URLs, making the process faster and more efficient. A key feature of this approach is the use of federated learning, where a Random Forest classifier is trained collaboratively across multiple distributed devices without sharing raw user data, thereby ensuring privacy. Overall, the system proactively identifies phishing URLs and either blocks or flags them, providing real-time alerts to users before they interact with potentially harmful links, thus enhancing both security and user trust.

Keywords: *Phishing Attacks, URL Filtering, Search Engine Security, Chat-based Communication, Phishing Detection System, Privacy-Preserving.*

PRIVACY-PRESERVING LOCAL LARGE LANGUAGE MODELS FOR SECURE AND LEAKAGE-FREE AI SYSTEMS

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ABSTRACT

This paper presents a unified architecture for resource-aware, privacy-preserving local large language model (LLM) systems that operate entirely on edge devices without reliance on cloud infrastructure. While recent advancements in open-weight models such as LLaMA have enabled on-device inference, existing implementations remain limited by static execution pipelines, weak memory abstractions, and potential data leakage in retrieval augmented generation (RAG) frameworks. To address these limitations, we propose a multi layered intelligent LLM framework that integrates three key innovations: a dynamic resource-adaptive inference engine that adjusts quantization levels and latency requirements; a cognitive memory hierarchy that combines short-term conversational context with long-term semantic and a privacy-preserving retrieval mechanism that mitigates sensitive data exposure through embedding obfuscation and controlled retrieval policies. Additionally, the system incorporates an autonomous agent layer capable of tool invocation, code execution, and iterative reasoning, enabling complex task completion in a fully offline environment. We implement the framework using optimized inference backends such as llama.cpp and lightweight orchestration layers, and evaluate its performance across diverse hardware configurations. Experimental results demonstrate that our approach achieves significant improvements in latency-efficiency trade-offs, enhances contextual coherence through structured memory utilization, and reduces privacy leakage risks compared to baseline local LLM pipelines, thereby establishing a foundation for next-generation edge AI systems that are adaptive, secure, and capable of autonomous reasoning without external dependencies.

Keywords: Local Large Language Models (LLMs), Edge AI Systems, Resource-Adaptive Inference, Retrieval-Augmented Generation (RAG), Privacy-Preserving Machine Learning, Cognitive Memory Architectures, Autonomous AI Agents, On-Device Intelligence.

A MODIFIED HILL CIPHER UTILIZING RANDOM BLOCK SIZES FORENHANCED CRYPTOGRAPHIC SECURITY

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ABSTRACT

Cryptography remains a fundamental component in safeguarding digital communications. Classical encryption methodologies, particularly the Hill cipher, are widely studied for their robust mathematical foundations grounded in matrix operations and linear algebra. Despite these pedagogical and theoretical advantages, the traditional Hill cipher exhibits significant security vulnerabilities. Its primary weakness stems from the utilization of a fixed-size key matrix for an entire plaintext message. This architectural rigidity exposes the cipher to standard cryptanalysis techniques, specifically known-plaintext and chosen-plaintext attacks. To mitigate these inherent weaknesses, this paper introduces the Random Block Size Modified Hill Cipher, an enhanced algorithm designed to integrate dynamic structural variation into the encryption process. In this proposed framework, the plaintext message is initially converted into a numerical format and subsequently segmented into blocks of heterogeneous lengths. Each variable-length plaintext block is then encrypted using a unique key matrix corresponding precisely to its block size. By implementing this dynamic block sizing, the algorithm exponentially increases the structural complexity of the encryption mechanism. Experimental evaluations confirm the efficacy of the proposed model; the resulting ciphertext exhibits markedly improved statistical randomness and heightened resistance against pattern-based cryptanalysis when benchmarked against the traditional Hill cipher. In conclusion, the Random Block Size Modified Hill Cipher provides a computationally straightforward yet highly effective paradigm for reinforcing classical data encryption systems against modern cryptanalytic threats.

Keywords: Hill Cipher, Dynamic Block Sizing, Cryptanalysis Resistance, Matrix Encryption, Secure Cryptography.

FIREGUARD AI: INTELLIGENT FIRE VS NON-FIRE DETECTION FOR SURVEILLANCE SYSTEMS

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ABSTRACT

Fire accidents pose a significant threat to life, property, and critical infrastructure, especially in areas monitored by surveillance systems. Traditional fire detection methods, such as smoke and heat sensors, often suffer from delayed response and false alarms caused by non-fire elements like sunlight, reflections, or moving objects. To address these limitations, this project titled “FIREGUARD AI: Intelligent Fire vs Non-Fire Detection for Surveillance Systems” proposes an advanced artificial intelligence-based approach for real-time fire detection. The system leverages deep learning and computer vision techniques to accurately distinguish between fire and non-fire scenarios in video streams captured by CCTV cameras. By training convolutional neural networks (CNNs) on diverse datasets containing fire and non-fire images, the model learns unique visual patterns such as flame color, motion, and texture. This enables faster and more reliable detection compared to conventional systems. FIREGUARD AI is designed to integrate seamlessly with existing surveillance infrastructure, providing continuous monitoring and instant alerts when fire is detected. The system minimizes false positives while maintaining high detection accuracy, making it suitable for deployment in public spaces, industrial environments, and smart cities

Keywords: *Fire Detection, Deep Learning, Computer Vision, Surveillance Systems, CNN (Convolutional Neural Networks), Real-time Monitorin*

NEXT-GENERATION DEEP LEARNING INTEGRATED DRONESECURITY: A 6G-POWERED ENABLED EDGE CLOUD ARCHITECTURE

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ABSTRACT

This paper presents a novel framework for securing next-generation drone ecosystems using deep learning integrated with 6G-enabled edge cloud architecture. As unmanned aerial vehicles (UAVs) become increasingly prevalent in applications such as surveillance, delivery, and disaster management, ensuring their security against cyber-physical threats is critical. The proposed architecture leverages advanced deep learning models deployed at the edge to detect anomalies in real-time, reducing latency and improving responsiveness. By integrating 6G communication technologies, the system achieves ultra-low latency, high bandwidth, and reliable connectivity, enabling efficient data transmission between drones, edge nodes, and cloud servers. The framework incorporates multi-layered security mechanisms including intrusion detection systems, encrypted communication protocols, and behavior-based anomaly detection. Deep neural networks are trained on diverse datasets to identify malicious patterns such as spoofing, jamming, and unauthorized access attempts. Experimental results demonstrate that the proposed system significantly improves threat detection accuracy while maintaining low computational overhead. The use of edge computing reduces dependency on centralized cloud infrastructure, enhancing scalability and resilience. In conclusion, this research highlights the potential of combining deep learning, 6G networks, and edge cloud computing to build a robust and intelligent drone security system for future smart environments.

Keywords: Drone Security, Deep Learning, 6G, Edge Computing, Cybers ecurity, UAV.

SMART ATTENDANCE AUTOMATION USING DEEP FACE RECOGNITION

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ABSTRACT

Traditional attendance systems are inefficient, error-prone, and vulnerable to manipulation such as proxy attendance. This project proposes a smart attendance automation system based on deep face recognition to eliminate manual intervention and improve accuracy, security, and scalability. The system leverages advanced deep learning models, particularly Convolutional Neural Networks (CNNs), to detect and recognize human faces in real time using video input from cameras. The proposed framework consists of face detection, feature extraction, and identity matching stages. Initially, faces are detected from live video streams using robust detection algorithms. Detected faces are then processed through a deep face recognition model to extract unique facial embeddings, which are compared against a pre trained database for identification. Upon successful recognition, attendance is automatically recorded with timestamps and stored in a centralized system. To ensure reliability, the system incorporates techniques such as data augmentation, illumination normalization, and anti spoofing measures to handle variations in lighting, pose, and facial expressions. Additionally, it supports real-time processing and can be integrated with cloud or local databases for efficient data management. Experimental results demonstrate high recognition accuracy and reduced processing time compared to traditional biometric systems. The proposed system significantly minimizes human effort, prevents fraudulent practices, and provides a seamless, contactless solution suitable for educational institutions and workplaces. Overall, this approach offers a scalable, secure, and intelligent alternative to conventional attendance methods by harnessing the power of deep learning and computer vision technologies.

Keywords: *Deep Face Recognition, Smart Attendance System, Facial Recognition, Convolutional Neural Networks (CNN), Computer Vision, Biometric Authentication, RealTime Face Detection, Feature Extraction.*

SATELLITE COMMUNICATION

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ABSTRACT

Satellite communication is a vital technology that enables long-distance transmission of data, voice, and video signals across the globe. It uses artificial satellites positioned in space to relay signals between Earth stations, overcoming geographical barriers and ensuring seamless connectivity. This technology plays a crucial role in various fields such as telecommunications, broadcasting, navigation, weather forecasting, and defense. The paper explores the fundamental concepts of satellite communication, including its working principles, types of satellites (geostationary, medium Earth orbit, and low Earth orbit), and key components such as transponders and ground stations. It also highlights the advantages of satellite systems, such as wide coverage area, reliability, and global reach, along with limitations like signal delay and high initial cost. Furthermore, recent advancements like high-throughput satellites (HTS), low Earth orbit (LEO) constellations, and their applications in modern communication systems are discussed. The study emphasizes the growing importance of satellite communication in bridging the digital divide and supporting emerging technologies like IoT and 5G.

Keywords: *Communication Artificial Satellites, Signal Transmission, Geostationary Orbit (GEO), Medium Earth Orbit (MEO), Low Earth Orbit (LEO), Transponders, Ground Stations, Global Connectivity, Wireless Communication, High Throughput Satellites (HTS), Satellite Networks, Telecommunication Systems, Internet of Things (IoT).*

QUANTUM CNN BASED THERMAL FACE RECOGNITION USING GATED ATTENTION AND ADAFACE CLASSIFIER

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ABSTRACT

Thermal face recognition is a biometric system used for secure and reliable person identification. Existing, visible-light face recognition systems fail under low light environments, occlusions and temperature variations, whereas thermal imaging captures stable facial heat patterns that enable robust identification in nighttime and occluded conditions such as masks, glasses and facial alterations. This paper proposes a hybrid Quantum-ResNet50 model for thermal face recognition. The proposed model integrates a modified ResNet50 for deep feature extraction with a variational quantum circuit to capture complex non-linear feature maps in a quantum feature space and the quantum circuit compresses high-dimensional deep features. The extracted features are used by thermal aware gated attention module to calculate thermal statistical information such as mean and variance to refine feature maps and an adaptive margin-based thermal AdaFace classifier adjusts classification boundaries using thermal variance to enhance inter-class separability and intra class compactness. Experimental results were conducted on both the charlotte and real time dataset that achieves accuracy of 99.93% and 96.5%. This provides a reliable solution for thermal biometric recognition systems operating in restricted environments.

Keywords: Thermal Face Recognition, Quantum Machine learning, Variational Quantum Circuit, ResNet, Gated Attention, Embedding layer, AdaFace, Adaptive Margin Loss, Cosine Similarity

SECURE ID PRIVACY AND INFERENCE THREAT PREVENTION MECHANISMS FOR DISTRIBUTED SYSTEMS

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ABSTRACT

This paper investigates facilitating remote collection of a patient's data in distributed system while protecting the security of the data, preserving the privacy of the patient's ID, and preventing inference attack. The paper presents a novel framework called SPID stand for a Secure, ID Privacy, and Inference Threat Prevention Mechanisms for Distributed Systems. In designing this framework, we make the following novel contributions. The SPID presents a novel architecture that supports the use of a distributed set of servers owned by different service providers. The SPID allows the patient to access these servers using certificates generated by the patient. The SPID allows the patient to select one server to be the home server, and select a number of servers to be the foreign servers. The patient uses the foreign servers to upload data. The home server is responsible for collecting the patient's data from the foreign servers and sending them to the healthcare provider. The SPID proposes a method for efficient verification of each request from the patient without searching in the server's database for the verification key. This is done by using some of the Elliptic Curves Cryptography (ECC) properties. The SPID has been analyzed using a bench-marking tool and evaluated using queuing theory. The evaluation results indicate an efficient performance when the number of servers increases. We uses Shannon entropy method to measure the likelihood of the inference attack .The proposed framework is applicable to distributed environments including cloud computing, federated learning, and collaborative data sharing platforms. Experimental analysis demonstrates that the approach effectively mitigates identity leakage and inference threats while maintaining acceptable computational and communication overhead.

Keywords: *Cryptography, privacy, Distributed Systems.*

METaverse TECHNOLOGY: TRANSFORMING DIGITAL INTERACTION AND VIRTUAL EXPERIENCES

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ABSTRACT

The metaverse is emerging as a transformative paradigm that converges multiple advanced technologies to create persistent, immersive, and shared virtual environments. It integrates virtual reality (VR), augmented reality (AR), artificial intelligence (AI), blockchain, and high-speed networking to enable seamless interaction between users and digital systems. This paper presents a comprehensive study of the architecture and underlying technologies that power the metaverse, including 3D rendering engines, spatial computing, edge and cloud infrastructure, and decentralized digital asset management. The research explores key application domains such as virtual education, remote collaboration, digital commerce, gaming, and healthcare, demonstrating how the metaverse enhances user engagement through real-time interaction and personalized experiences. Special emphasis is placed on the role of digital avatars, virtual economies, and non-fungible tokens (NFTs) in shaping user identity and ownership within these environments. Furthermore, the paper analyzes critical challenges associated with the widespread adoption of metaverse technologies, including data privacy risks, cybersecurity threats, interoperability issues among platforms, and the ethical implications of virtual identities and digital inclusion. Scalability and latency concerns in delivering real-time immersive experiences are also examined. To address these challenges, the study discusses potential solutions such as standardized protocols, secure identity management systems, and advancements in network technologies like 5G and beyond. The paper concludes by highlighting future research directions and the need for collaborative efforts between academia, industry, and policymakers to ensure the development of a secure, inclusive, and sustainable metaverse ecosystem.

Keywords: *Metaverse Virtual Reality (VR), Augmented Reality (AR), Extended Reality (XR), Artificial Intelligence (AI), Blockchain, Edge Computing, Interoperability, Non-Fungible Tokens (NFTs), Human-Computer Interaction (HCI).*

FEDERATED LEARNING SYSTEM FOR DIABETES MONITORING AND RISK PREFEDHEALTH-DM: A SMART DICTION

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ABSTRACT

Federated Learning is a distributed machine learning approach that enables collaborative model training without sharing raw patient data. This project utilizes Federated Learning to develop a privacy-preserving disease diagnosis system for diabetes with blockchain technology. Multiple healthcare centers locally train machine learning models using their patient data. Only encrypted model parameters are shared with a blockchain enabled central server for global model aggregation. The proposed system integrates Machine Learning for real-time diabetes prediction and decision support. Key health features include glucose level, blood pressure, insulin level, BMI, age, and family history. A Random Forest classifier is used due to its robustness and high prediction accuracy. The trained federated model performs real time classification of diabetic conditions. Patients are categorized into different risk levels for clinical interpretation.

Keyword: *Python, Web Application, MySQL Server, Federated Model Aggregation with Blockchain*

HOTEL BOOKING WEB APPLICATION USING MERN STACK

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ABSTRACT

This research explores the development of a full-stack hotel booking web application utilizing the MERN (MongoDB, Express.js, React.js, and Node.js) stack. The application is designed to streamline the process of hotel reservation by providing a seamless user experience for customers while offering an efficient management system for hotel administrators. The proposed system leverages the scalability and flexibility of the MERN stack to address the challenges faced in traditional hotel booking and management systems. The application features a responsive and dynamic user interface built using React.js, which allows customers to search for hotels, filter results based on various criteria, view detailed room information, and complete bookings with integrated payment gateways. The backend, developed using Node.js and Express.js, provides a robust and secure API for handling user authentication, booking processes, and realtime availability updates. MongoDB serves as the database, offering a scalable and flexible solution for storing user data, hotel details, and transaction records. This study evaluates the applications performance, scalability, and usability through testing and user feedback. The results demonstrate the MERN stack's effectiveness in creating a high performing, scalable, and interactive web application for hotel booking systems. The research highlights the potential of modern web development frameworks in transforming traditional business operations and improving user experiences in the hospitality industry.

Keywords: *MongoDB Express.js React.js Node.js (MERN) stack, Full-stack web development, MongoDB, Express.js, React.js, Node.js, JavaScript frameworks, Web application architecture.*

BRAIN-COMPUTER INTERFACE: BRIDGING HUMAN MINDS AND MACHINES

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ABSTRACT

Brain-Computer Interface (BCI) A Brain-Computer Interface (BCI) is an advanced technology that enables direct communication between the human brain and external devices without the need for physical movement. It works by detecting brain signals, interpreting them using algorithms, and converting them into commands that can control computers, prosthetic limbs, or other machines. BCIs are widely used in medical fields to assist individuals with paralysis, neurological disorders, and disabilities, helping them regain communication and control over their environment. In addition, this technology has applications in gaming, virtual reality, and cognitive research. Despite its potential, BCI faces challenges such as signal accuracy, cost, and ethical concerns. Overall, BCI represents a promising step toward integrating human intelligence with machines, improving quality of life and expanding human capabilities.

Keywords: Brain-Computer Interface (BCI), Neural Signals, Signal Processing, Human-Computer Interaction, Neurotechnology, Assistive Technology, Prosthetic Control.

BRAIN-COMPUTER INTERFACE (BCI)

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ABSTRACT

A Brain-Computer Interface (BCI) is an advanced technology that enables direct communication between the human brain and external devices without the use of physical movements. It works by acquiring brain signals, typically through electroencephalography (EEG), and translating them into commands that can control computers, prosthetic limbs, or other electronic systems. This project focuses on understanding the fundamental principles of BCI systems, including signal acquisition, preprocessing, feature extraction, and classification. The system interprets neural signals generated by brain activity and converts them into meaningful outputs using machine learning algorithms. BCIs have significant applications in medical and assistive technologies, particularly for individuals with disabilities such as paralysis, allowing them to interact with their environment and regain independence. In addition to healthcare, BCI technology is also being explored in gaming, virtual reality, and smart environments. However, challenges such as signal noise, accuracy, cost, and ethical concerns remain critical areas for research. This project aims to provide an overview of BCI technology, its working mechanisms, applications, and future potential, highlighting its role in bridging the gap between human cognition and machine interaction.

Keywords: Brain-Computer Interface (BCI), Electroencephalography (EEG), Neural Signals, Signal Processing, Machine Learning, Feature Extraction, Human-Computer Interaction (HCI), Assistive Technology, Neurotechnology, Prosthetic Control, Artificial Intelligence (AI), Biomedical Engineering.

SECURITY IN HEALTHCARE: ENHANCING THE SAFETY OF DATA WITH CYBER SECURITY

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ABSTRACT

The rapid advancement of digitalization in healthcare infrastructure has improved patient care delivery, operational productivity, and the accessibility of medical services. However, this transformation has simultaneously exposed confidential patient records to a growing landscape of cyber risks. Contemporary healthcare environments comprise front-end elements such as patient portals, mobile applications, administrative dashboards, and telemedicine platforms, alongside back-end components including servers, databases, cloud repositories, APIs, and data processing systems. Each of these layers presents distinct security weaknesses that can be exploited through ransomware attacks, phishing schemes, malicious software, unauthorized intrusions, and data compromises. Any disruption to data accuracy or privacy may result in legal consequences, financial damages, and erosion of patient confidence. This study proposes a comprehensive cybersecurity framework addressing both front-end and back-end vulnerabilities within healthcare environments. Front-end protective measures focus on robust user identity verification, encrypted communication channels, input validation, and mitigation of interface-based security flaws. Back-end countermeasures encompass data encryption during storage, role-based access management, secure API development, intrusion detection mechanisms, and real-time anomaly surveillance.

Keywords: Healthcare Cyber security, Front-End Security, Back-End Security, Data Protection, HIPAA Compliance, GDPR, ISO 27001, Intrusion Detection System, Data Encryption, Ransomware, Phishing Attacks, Access Control, Telemedicine Security, Cloud Security, Digital Healthcare Systems

AN INTELLIGENT LUNG CANCER DETECTION SYSTEM USING CONVOLUTIONAL NEURAL NETWORK-BASED CT IMAGE ANALYSIS FOR EARLY-STAGE PULMONARY NODULE CLASSIFICATION

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ABSTRACT

Lung cancer continues to account for a disproportionately high share of cancer-related mortality globally, underscoring the critical importance of timely and precise diagnostic intervention. Conventional radiological screening methods are often constrained by inter-observer variability and the cognitive burden placed on radiologists when evaluating large volumes of imaging data. To address these limitations, this study introduces an intelligent lung cancer detection system that integrates deep learning with Computed Tomography (CT) image analysis. The proposed system employs a Convolutional Neural Network (CNN) architecture that autonomously extracts hierarchical spatial features from CT scan slices, enabling accurate discrimination between malignant pulmonary nodules and benign tissue structures. The network is trained and validated on publicly accessible benchmark CT datasets, and undergoes rigorous hyperparameter tuning to optimize classification performance across diverse patient demographics. Quantitative evaluation metrics including accuracy, sensitivity, specificity, and Area under the Receiver Operating Characteristic Curve (AUC-ROC) confirm the model's superior diagnostic reliability compared to conventional image processing baselines. The system operates in a fully automated, non-invasive manner, requiring no manual feature engineering, thereby reducing diagnostic turnaround time and minimizing human error. The findings suggest that the proposed CNN-based framework holds strong clinical potential as a decision-support tool for radiologists, facilitating earlier-stage detection of lung malignancies and consequently contributing to improved therapeutic outcomes and patient survival rates.

Keywords: lung cancer detection, convolutional neural network, computed tomography, pulmonary nodule classification, AUC-ROC evaluation, non-invasive diagnosis.

AN ENHANCED ATM SECURITY FRAMEWORK USING DEEP CONVOLUTIONAL NEURAL NETWORK-BASED FACIAL RECOGNITION WITH DYNAMIC FACE VERIFICATION LINK GENERATION

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ABSTRACT

The widespread adoption of Automated Teller Machines (ATMs) has revolutionized modern banking; however, conventional authentication mechanisms relying solely on magnetic-stripe cards and Personal Identification Numbers (PINs) remain critically vulnerable to skimming attacks, card cloning, and social-engineering fraud. This paper presents a multi-factor ATM security framework that augments physical card authentication with real-time biometric identity verification using a Deep Convolutional Neural Network (DCNN). The proposed system captures a live facial image of the transaction initiator at the point of card insertion, extracts discriminative feature embeddings through a fine-tuned convolutional architecture, and performs one-to-one face verification against the account holder's pre-enrolled reference template stored in the bank's secure database. In the event of a verification mismatch, the system dynamically generates a time-bound Face Verification Link and dispatches it to the registered mobile number of the account holder, enabling the legitimate owner to authorize or deny the transaction remotely. Experimental evaluation on benchmark face datasets demonstrates that the framework achieves high verification accuracy with low false acceptance and false rejection rates, while maintaining an end-to-end response time suitable for practical ATM deployment. The proposed solution effectively mitigates unauthorized access without requiring additional hardware beyond a standard webcam module, offering a scalable and cost-efficient upgrade path for existing ATM infrastructure.

Keywords: ATM Security, Facial Recognition, Deep convolutional neural network, Biometric authentication, Multi-factor authentication, face verification unauthorized access prevention, Feature Embedding, Banking Fraud Detection, One-time verification link.

A RELIABLE E-COMMERCE BUSINESS MODEL USING BLOCKCHAIN

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ABSTRACT

This project builds upon a SHA-256 cryptographic algorithm developed by our senior team member, extending it into an advanced, multi-chain blockchain architecture. The proposed system integrates Ethereum-based smart contract logic with Solana's high-throughput blockchain layer to create a secure, scalable, and privacy-preserving platform. The core objective is to design a decentralized login and wallet framework where user identities and transaction flows remain non-trackable at the application level, while still maintaining cryptographic integrity and verifiability at the blockchain layer. By leveraging SHA-256 for hashing, along with cross-chain validation principles, the platform ensures data immutability, resistance to tampering, and enhanced anonymity. This hybrid blockchain approach combine Ethereum's mature smart contract ecosystem with Solana's performance advantages, enabling fast authentication, efficient wallet interactions, and reduced latency. The abstraction layer isolates user-facing login mechanisms from on-chain identity traces, minimizing correlation risks without compromising security or compliance. Overall, the system aims to deliver a next-generation decentralized authentication and wallet platform that prioritizes privacy, scalability, and cryptographic robustness, suitable for modern Web3 applications requiring secure and anonymous user access.

Keywords: *SHA-256, Blockchain, Ethereum, Solana, Decentralized Authentication, Privacy Preservation*

DEEP LEARNING-BASED DROWSINESS DETECTION SYSTEM FOR DRIVER'S SAFETY

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ABSTRACT

Driver drowsiness is a major cause of road accidents, leading to over 100,000 crashes and nearly 1,000 fatalities annually in the United States, according to the National Safety Council. To address this issue, we propose a real-time Driver Drowsiness Detection System with high accuracy and fast performance. The system combines two deep learning approaches: a custom Convolutional Neural Network (CNN) with a Support Vector Machine (SVM), and a lightweight transfer-learning model. We evaluated these models using two datasets: a four-class Kaggle dataset and the MRL eye dataset. The CNN+SVM model was optimized using dropout, split ratios, and L2 regularization. This model achieved 100% training accuracy and 99.7% validation accuracy. The transfer-learning model reduced training time and achieved 99.4% training accuracy and 99.1% validation accuracy. We compared both models using performance metrics such as confusion matrix, precision, recall, F1-score, and loss curves. The results show that real-time driver drowsiness detection is possible using standard hardware. This system can help improve road safety and reduce accidents effectively.

Keywords: Convolutional neural network (CNN), driver drowsiness, deep learning, eye aspect ratio (EAR), L2 regularization, mouth aspect ratio (MAR), OpenCV, support vector machine (SVM), transfer learning.

HIGH-SECURITY HEVC VIDEO STEGANOGRAPHY METHOD USING THE MOTION VECTOR PREDICTION INDEX AND MOTION VECTOR DIFFERENCE

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ABSTRACT

Recent advancements in steganalysis have exposed vulnerabilities in High Efficiency Video Coding (HEVC) steganography, particularly through methods that exploit the local optimality of Motion Vector Prediction (MVP). Existing motion vector (MV) domain algorithms often disrupt the optimality of Advanced Motion Vector Prediction (AMVP), making them detectable. To address this, this paper presents a novel MV-domain steganography method for HEVC based on the MVP index and Motion Vector Difference (MVD). The proposed approach first establishes the necessary constraints for steganographic embedding to resist attacks targeting MVP optimality and other conventional steganalysis features. We then introduce a specialized distortion function designed to minimize embedding impact, complemented by an inter-frame-based message embedding and extraction algorithm. Experimental results demonstrate that the proposed method effectively resists optimality-based attacks and maintains high security against traditional steganalysis. Furthermore, the algorithm preserves superior visual quality and coding efficiency, making it highly viable for practical video-based covert communication.

Keywords: HEVC video steganography, Advanced Motion Vector Prediction (AMVP), Local optimality, Video steganalysis, Motion Vector Difference (MVD).

AI-BASED PERSONAL FINANCE MANAGEMENT SYSTEM

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ABSTRACT

The increasing use of digital payment methods has created a strong demand for smarter personal finance management systems. This project introduces an AI-powered finance manager that automatically tracks expenses from SMS messages, app notifications, and receipt images. It utilizes Optical Character Recognition (OCR) and Natural Language Processing (NLP) to extract important details such as transaction amount, merchant name, and date. The system applies a machine learning algorithm to categorize expenses into groups like food, travel, and shopping, helping users gain better financial understanding. It also provides features such as budget tracking, instant alerts, and summarized reports to support effective money management. The model was tested with real-time data and delivered over 90% accuracy in extracting information using OCR and more than 85% accuracy in expense classification. Overall, the system minimizes manual work, enhances accuracy, and offers an intelligent solution for tracking and controlling personal finances.

Keywords: Artificial Intelligence, Machine learning, Optical Character Recognition, Natural Language Processing, Long Short-Term Memory, Autoregressive Integrated Moving Average.

BIOCHAINVOTE: A SECURE BIOMETRIC VOTING FRAMEWORK USING FINGERPRINT AND FACIAL RECOGNITION WITH BLOCKCHAIN

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ABSTRACT

Electronic voting (e-voting) systems are digital platforms used to conduct elections by allowing voters to cast their votes electronically instead of using traditional paper ballots. These systems aim to improve efficiency, reduce counting time, and simplify election management. However, many existing electronic voting systems face significant challenges, including voter impersonation, unauthorized access, centralized data storage, and vulnerability to cyberattacks. In some cases, the lack of transparency and reliance on centralized databases increase the risk of vote tampering, data manipulation, and single points of failure. Additionally, conventional authentication methods such as ID cards or passwords are not always sufficient to guarantee the true identity of voters. To address these issues, the proposed system introduces a secure and decentralized electronic voting platform that integrates biometric authentication and blockchain technology. The system uses face recognition and fingerprint recognition to ensure strong voter verification. Facial features are extracted using computer vision-based algorithms, while fingerprint images are processed using minutiae-based techniques for accurate identification. Only voters who successfully pass both biometric verifications are granted access to the voting interface, thereby preventing impersonation and unauthorized participation. Once a vote is cast, it is securely recorded as a transaction on a blockchain ledger. The blockchain ensures immutability, transparency, and decentralization, preventing any alteration or unauthorized modification of votes. By combining multi-factor biometric authentication with blockchain technology, the proposed system enhances security, trust, and integrity in electronic voting processes.

Keywords: *Electronic Voting, Biometric Authentication, Face Recognition, Fingerprint Verification, Blockchain Technology, Decentralized Voting System, Secure Election Process.*

SMFA: STRENGTHENING MULTI-FACTOR AUTHENTICATION WITH STEGANOGRAPHY FOR ENHANCED SECURITY

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ABSTRACT

Traditional password-based authentication mechanisms exhibit significant security vulnerabilities, prompting the adoption of Multi-Factor Authentication (MFA) to enhance user verification. However, current MFA methods, such as OffPAD, One-Time Password Tokens (OTT), and smartcard-based systems, remain vulnerable to attacks like Man-in-the-Middle (MITM), session hijacking, replay, phishing, and denial of service (DoS). Additionally, the conventional single-server authentication approach is inefficient and inadequate for modern security needs. This study introduces Secure Multi-Factor Authentication (SMFA), a novel framework designed to address these challenges by leveraging steganography for secure credential transmission, reducing susceptibility to MITM and session hijacking attacks. SMFA also incorporates an additional Universal Serial Bus (USB) device as a supplementary authentication factor and employs a multi-server architecture to overcome the limitations of single-server models. A comprehensive analysis comparing User authentication, multi-factor authentication model (MFA), steganography, cryptography, privacy and security of SMFA to existing MFA protocols reveals its superior ability to counter MITM, replay, DoS, user impersonation, and password-guessing attacks. The results demonstrate that SMFA offers a robust and effective solution, addressing the weaknesses of both traditional password-based systems and current MFA methods.

Keywords: *User authentication, multi-factor authentication model (MFA), steganography, cryptography, privacy and security*

BOUNDARY-AWARE U-NET++ WITH HYBRID OPTIMIZATION FOR OVARIAN TUMOR SEGMENTATION IN ULTRASOUND IMAGES

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ABSTRACT

Ultrasound imaging is widely used for ovarian tumor diagnosis due to its low cost, portability, and real-time capability; however, precise manual delineation of tumor regions is time-consuming and highly dependent on clinical expertise. Automatic segmentation remains challenging because of speckle noise, low contrast, irregular boundaries, and large variations in lesion size. In this paper, we propose a stage-aware deep learning framework for accurate ovarian tumor segmentation using a U-Net++ architecture with a ResNet34 encoder as the backbone feature extractor. To incorporate clinical relevance, lesions are grouped into three stages: early, suspicious, and malignancy-likely, based on mask area ratios, enabling stratified evaluation across different tumor scales. A hybrid loss function combining Dice loss, Focal loss, and Boundary loss is employed to improve region overlap, handle class imbalance, and enhance boundary precision. In addition, largest connected component post-processing is applied to suppress spurious predictions. Experiments conducted on 1,469 ultrasound images demonstrate strong and consistent performance, achieving a global Dice score of 94.9%, with stage-wise Dice scores of 84.3%, 92.4%, and 96.1% for early, suspicious, and malignancy-likely stages, respectively. The proposed method provides reliable and robust segmentation and shows potential for assisting clinicians in computer-aided diagnosis.

Keywords: medical image segmentation, ultrasound imaging, ovarian tumor, U-Net++, deep learning, hybrid loss, computer-aided diagnosis.

MOBILE HEALTH APP FOR CHRONIC DISEASE MONITORING

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ABSTRACT

Chronic diseases require continuous monitoring and timely medical intervention, which is often lacking in traditional healthcare systems. This paper presents a mobile-based health monitoring application designed for real-time tracking and management of chronic diseases. The system utilizes cloud-based data storage, machine learning-based risk prediction, and threshold-based alert mechanisms to analyze patient health data. It enables monitoring of vital parameters such as blood glucose, blood pressure, heart rate, and weight, along with features like medication reminders, chat and video consultation, and wearable data integration. The proposed system improves early risk detection, enhances doctor patient communication, reduce hospital visits, and provides a cost-effective solution for long-term healthcare management.

Keywords: *chronic diseases, risk prediction, blood glucose, blood pressure, heart rate, weight.*

A CAREER PATH RECOMMENDER USING MACHINE LEARNING

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ABSTRACT

Career path selection remains a significant challenge for students due to the vast number of available options and the lack of personalized guidance systems. Traditional career counseling approaches primarily rely on academic performance and often fail to incorporate critical factors such as individual skills, interests, and personality traits, leading to suboptimal career decisions. In this paper, we propose an intelligent Career Path Recommender System based on machine learning techniques to deliver personalized career suggestions. The system analyzes multiple dimensions of student data, including academic performance, skill sets, and personal interests. To enhance recommendation accuracy, the proposed model integrates personality assessment using the Big Five personality framework with data-driven learning. The system is trained on a Kaggle dataset containing industry-relevant skills and corresponding job roles. Two classification algorithms, Random Forest and Support Vector Machine (SVM), are implemented and evaluated. Experimental results indicate that the Random Forest model outperforms SVM, achieving an accuracy of 90%, precision of 0.89, and recall of 0.88. Furthermore, the proposed system is implemented as a mobile application using the Flutter framework, ensuring accessibility and user-friendly interaction. The integration of personality traits with machine learning distinguishes this work from traditional approaches and improves the relevance of career recommendations. Overall, the proposed system provides a robust, scalable, and data-driven solution to assist students and educational institutions in making informed and effective career decisions. A Career Path Recommender Using Machine Learning.

Keywords: Machine Learning, Career Path Recommendation, Random Forest, Support, Vector Machine, Skill Assessment, Personalized Recommendation, Kaggle Dataset.

ALUMNI RELATIONSHIP MANAGEMENT AND DATA PLATFORM

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ABSTRACT

Traditional alumni management systems rely on outdated databases or manual tracking, which lack real-time engagement and active participation. This project addresses these challenges by developing a Unified Digital Alumni Connect Platform that enables seamless networking, secure data management, and real-time interaction. The proposed system features distinct role-based dashboards for Administrators, Alumni, and Students, built on a robust Node.js and React architecture. It empowers alumni to create extensive professional profiles, post job opportunities, and engage directly with students. Students can seamlessly apply for jobs, request mentorships, and receive professional guidance. The platform utilizes advanced real-time communication via WebSockets, ensuring instant synchronization of job applications, mentorship updates, and direct messaging without requiring page refresh. Furthermore, an administrative module with Role-Based Access Control (RBAC) ensures strict data governance, where admins can approve alumni profiles, manage permissions, and safely oversee platform activity using cascading deletion algorithms. By uniting modern web technologies, secure authentication, and real-time event-driven architecture, this centralized platform fosters a vibrant institutional community, enhances career prospects for students, and provides a scalable, sustainable approach to long-term alumni engagement.

Keywords: *WebSockets, Role-Based Access Control (RBAC)*

DESIGN AND IMPLEMENTATION OF A QR-BASED HOSTEL LEAVE MANAGEMENT SYSTEM

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ABSTRACT

Traditional hostel leave management systems rely on manual processes that are inefficient, error-prone, and lack real-time security. This paper presents a QR-Based Hostel Leave and Access Control System design during a client server architecture to automate leave requests, approvals, and entry/exit monitoring. Students submit leave applications through a mobile interface, which are processed using a role-based approval workflow involving the deputy warden and principle for extended durations. Upon approval, a secure, time-bound QR code is generated, encoding leave details and authorization status. At the hostel gate, QR codes are scanned and validated against server records using timestamp and status verification to ensure secure access control. The system also supports emergency leave extensions through authorized requests, enhancing flexibility. All transactions are stored in a centralized database for improved traceability, auditability, and data management. The proposed solution significantly reduces administrative overhead, improves operational efficiency, and strengthens security compared to conventional manual systems.

Keywords: *QR-Based Hostel Leave, sarestoredina, conventional*

A WEB-BASED QUEUE MANAGEMENT SYSTEM WITH QR CODE INTEGRATION AND REAL-TIME NOTIFICATIONS

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ABSTRACT

Efficient queue management is essential in service-oriented environments such as hospitals, banks, and government offices, where traditional manual systems often lead to long waiting times, overcrowding, and lack of transparency. This paper presents a web-based Queue Management System designed to automate and optimize the queue handling process. The proposed system enables users to generate digital tokens remotely and provides a unique QR code for secure and quick verification at service counters. It offers real-time queue tracking by displaying the current token, user position, and dynamically calculated estimated waiting time based on queue length and service rate. Additionally, an automated notification system informs users about queue progress and alerts them when their turn approaches, reducing unnecessary waiting and crowding. An admin dashboard is integrated to efficiently manage queue operations, including token control, service management, and performance monitoring. The system enhances transparency, improves operational efficiency, and provides a user-friendly experience, making it a scalable and effective solution for modern digital queue management.

Keywords: *Queue Management System, Web-Based Application, QR Code Integration, Digital Token, Real-Time Queue Tracking, Estimated Waiting Time, Notification System, Service Optimization*

AI-BASED SKIN DETECTION USING DEEP LEARNING

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ABSTRACT

Skin diseases are among the most common health issues worldwide, affecting millions of people every year. Early detection of skin diseases such as melanoma, basal cell carcinoma, and benign keratosis is critical for timely treatment and prevention of severe complications. Traditional diagnosis methods rely on dermatologists' expertise and manual examination, which can be time-consuming and may lead to delayed detection in resource-limited areas. This research proposes an AI-based skin disease detection system using deep learning techniques to automatically classify skin lesions from images. The system uses a Convolutional Neural Network (CNN) and transfer learning with the VGG16 architecture to analyze dermoscopic images from the HAM10000 dataset. Several preprocessing techniques including hair removal, noise reduction, illumination correction, and lesion segmentation are applied. A. Many skin conditions appear similar in their early stages, making accurate diagnosis difficult without proper medical expertise. Certain diseases such as melanoma and basal cell carcinoma can become dangerous if they are not detected at an early stage. Therefore, early and accurate diagnosis of skin diseases is essential for effective treatment and prevention of complications. The trained model predicts skin disease categories and provides top-3 prediction probabilities. Additionally, risk analysis and Grad CAM visualization are used to highlight important regions influencing the prediction, improving the interpretability of the system. A Streamlit-based web interface allows users to upload images and receive real-time predictions and risk assessment. Experimental results demonstrate that the proposed system can effectively assist in early skin disease detection, providing a useful decision support tool for healthcare professionals and remote diagnosis systems.

Keywords: *Skin Disease Detection, Deep Learning, CNN, VGG16, HAM10000 Dataset, Medical Image Processing, Grad-CAM, Streamlit, Artificial Intelligence in Healthcare*

VOICE-TRIGGERED WOMEN PROTECTION APP

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ABSTRACT

Women's safety remains a critical concern, especially in situations where immediate manual interaction with a mobile device is not feasible. This paper presents a Voice-Triggered Women Protection App, a smart mobile-based solution designed to provide rapid emergency assistance through voice commands. The system enables users to activate safety features by speaking a predefined keyword or phrase, eliminating the need for physical interaction during distress situations. The proposed application is developed using modern mobile technologies and integrates modules such as voice recognition, real-time location tracking, and automated alert systems. Upon detecting the trigger phrase, the application instantly sends emergency messages along with the user's live GPS location to pre-registered contacts and can optionally initiate a call or alarm. The system ensures minimal response time and operates effectively even under constrained conditions. The architecture includes a user-friendly interface for contact management, background voice monitoring, and secure data handling. The implementation focuses on reliability, low power consumption, and quick activation to enhance usability in real-world scenarios. Experimental evaluation demonstrates the effectiveness of the system in providing timely alerts and improving personal safety. This solution contributes to empowering women by leveraging voice-based interaction and mobile computing, offering a practical, accessible, and efficient approach to emergency response and personal security.

Keywords: *GPS, Voice-Triggered, distress situations.*

WITNESS MANAGEMENT AND REMINDER SYSTEM WITH PREDICTIVE INTELLIGENCE

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ABSTRACT

The judicial system often faces significant delays due to the unavailability or delayed appearance of witnesses, which affects the timely delivery of justice. To overcome this challenge, this paper presents a Witness Management and Reminder System with Predictive Intelligence, aimed at improving the efficiency and reliability of witness handling in legal proceedings. The proposed system utilizes data analytics and machine learning techniques to analyze historical attendance patterns and predict the likelihood of witness availability. Based on these predictions, the system assists legal authorities in better scheduling and planning of court hearings. Additionally, it incorporates an automated reminder mechanism that sends timely notifications to witnesses via SMS, email, and mobile alerts, ensuring improved communication and reduced absenteeism. The system features a user-friendly interface that enables court officials to manage witness records, monitor attendance, and receive real-time updates. The predictive intelligence component identifies potential risks of non-attendance and suggests proactive measures to mitigate them. By reducing case adjournments and enhancing coordination, the proposed solution contributes to a more efficient, transparent, and accountable judicial process. This system demonstrates how predictive intelligence can be effectively applied to address real-world challenges in legal systems.

Keywords: *Predictive, SMS, email, mobile alerts, proactive.*

AI-BASED RESUMES CREENING SYSTEM

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ABSTRACT

The AI-Based Resume Screening System is designed to automate the recruitment process by intelligently analyzing and filtering candidate resumes. The system allows applicants to upload their resumes, which are then processed using Optical Character Recognition (OCR) and Artificial Intelligence techniques to extract relevant information such as skills, qualifications, and experience. The extracted data is compared with predefined job requirements and skill sets for specific job roles. Based on the similarity and relevance, the system calculates a matching score for each resume. Candidates with higher scores are considered better matches for the job role, while lower scores may indicate the need for additional skills or improvements. This automated approach reduces manual effort, saves time for recruiters, and improves the efficiency and accuracy of candidate selection.

Keywords: *Optical Character Recognition (OCR), automated approach, Artificial Intelligence.*

AUTOMATED MALWARE ANALYSIS AND DETECTION SYSTEM

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ABSTRACT

Malware has become a major Cyber security threat, causing serious damage to computer systems, networks, and sensitive data. Traditional signature-based detection methods often fail to detect newly emerging or unknown malware. This project proposes a Malware Detection System using Machine Learning techniques to automatically identify whether a file or program is malicious or benign based on its features. Data preprocessing techniques are applied to clean the dataset, handle missing values, and convert raw data into a suitable format for training machine learning models. Feature selection is performed to identify the most relevant attributes that contribute to malware detection, which improves the efficiency and accuracy of the model. A machine learning classification algorithm is trained and tested using the prepared dataset to accurately classify files as malware or benign. The proposed system helps improve Cyber security by enabling faster and more accurate malware detection compared to traditional methods.

Keywords: *Cyber security, Malware, dataset.*

AUTOMATIC CALCULATION OF CARDIOMETRIC COEFFICIENTS ON CHEST X-RAY IMAGES

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ABSTRACT

This automated system calculates cardio metric coefficients from Chest X-ray (CXR) images, and addressing the limitations of traditional manual methods which are often time-consuming and prone to variability across observers. Leveraging the capabilities of deep learning, particularly convolutional neural networks (CNNs), the system performs end-to-end analysis by first enhancing image quality through preprocessing steps such as noise reduction, contrast enhancement, and normalization. It then applies sophisticated segmentation techniques, including models like U-Net and MaskR-CNN, to accurately delineate critical anatomical structures such as the lungs and thoracic cavity without requiring manual annotation. Following segmentation, the system extracts relevant cardiometric features automatically using CNN-based feature extraction, enabling precise measurement of important clinical parameters such as the Cardiothoracic Ratio (CTR) and Lung Area Index. These quantitative measurements are then utilized within a classification framework to distinguish between normal and abnormal chest X-rays, facilitating early detection of cardiovascular and pulmonary abnormalities. The system's performance is rigorously validated against manually annotated datasets, demonstrating high accuracy, reliability, and robustness across diverse imaging conditions. By automating complex image interpretation tasks and providing objective metrics, this approach aims to support radio logistics in delivering faster, more consistent cardiac assessments, ultimately enhancing diagnostic workflows and contributing to improved patient care.

Keywords: *convolutional neural networks (CNNs), Cardiothoracic Ratio (CTR), MaskR-CNN.*

LIGHT WEIGHT AUTHENTICATION PROTOCOL FOR IOT DEVICES

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ABSTRACT

The rapid growth of IoT has introduced significant security challenges due to resource constrained devices. Traditional authentication mechanisms are often unsuitable because of their high computational and energy requirements. This project proposes a lightweight authentication protocol designed specifically for IoT environments. The protocol utilizes hash functions, XOR operations, and nonce-based challenge-response techniques to achieve secure mutual authentication between devices and the server. It effectively mitigates common attacks such as replay, impersonation, and man-in-the-middle attacks. The proposed system reduces authentication delay and energy consumption, making it suitable for real-time IoT applications such as smart homes, healthcare, and industrial automation. A prototype implementation using ESP32 demonstrates secure communication and efficient authentication.

Keywords: XOR operations, ESP32, IoT.

CREDIT CARD FRAUD DETECTION USING MACHINE LEARNING

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ABSTRACT

Credit card fraud has become a significant challenge in the financial sector due to the rapid growth of digital transactions. Detecting fraudulent activities accurately and efficiently is essential to minimize financial losses and enhance customer trust. This project presents a machine learning-based approach for credit card fraud detection, utilizing advanced data analysis techniques to identify suspicious transaction patterns. The proposed system employs various machine learning algorithms to analyze historical transaction data and distinguish between legitimate and fraudulent activities. Data preprocessing techniques such as normalization and feature selection are applied to improve model performance. Due to the highly imbalanced nature of fraud datasets, appropriate methods are used to handle class imbalance and ensure reliable predictions. The model is trained and evaluated using performance metrics such as accuracy, precision, recall, and F1score. The results demonstrate that machine learning techniques can effectively detect fraudulent transactions with high accuracy while reducing false positives. This project highlights the importance of intelligent systems in financial security and demonstrate show machine learning can be used to build efficient and scalable fraud detection solutions.

Keywords: *Fraudulent, Normalization, Datasets.*

AI ASSISTANT FOR PATH HOLE DETECTION AND LANEDTECTION

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ABSTRACT

Road safety has become increasingly problematic due to the density of traffic and limited repairs on road surfaces over the last several years; potholes, cracks, and generally poor road surfaces contribute to these problems. Confusion due to unclear lane markings creates additional obstacles to smooth driving. Increased road usage also results in higher probabilities of accidents or vehicle damage and the need for intelligent systems that will monitor these problems early on. The goal of this project is to create an intelligent automobile system using artificial intelligence, deep learning techniques, and traditional computer vision techniques to enable real-time lane detection and real-time detection of surface damage on roads. We use the state-of-the-art object detection technique known as YOLOv8 to accurately identify potholes, cracks, and blemishes on the road surface. We employ Canny edge detection followed by Hough Transform for lane detection; this allows us to extract stable boundary lines in adding some degree of reliability to many of the examples we see on the road in India, even when there is low visibility or little definition of a line. As a result, we find that by combining the use of column and circuit detections, we have produced an overall performance rating for reliably identifying lane markings and identifying road conditions as the final outcome. The findings of this paper demonstrate that when combined, computer vision and artificial intelligence provide a solid foundation for future development in traffic safety technology.

Keywords: YOLOv8, potholes, Canny edge

A BLOCKCHAIN FRAMEWORK FOR SECURE IDENTITY VERIFICATION AND FAKE ACCOUNT PREVENTION IN SOCIAL MEDIA

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ABSTRACT

This project proposes a block chain-integrated social media system to address fake accounts using secure and decentralized identity verification. Every user must undergo a multi-level identity verification process during registration. Users provide basic profile information along with a government-issued identity credential (such as Aadhaar or voter ID) and a fingerprint biometric sample. The fingerprint is processed using a Pattern-Based Ridge Matching Algorithm, which extracts unique ridge structures and patterns to generate a reliable biometric template for identification. User registration details and verified identity information are converted into cryptographic hash values and securely stored on the blockchain to preserve privacy. Smart contracts verify hash uniqueness and enforce a one user-one-identity policy, automatically detecting and rejecting fake or duplicate accounts. The proposed framework enhances security, transparency, privacy, and trust in social media networks while preventing large-scale fake account creation.

Keywords: Blockchain, Identity Verification, Fake Account Prevention, Decentralized System, Data Privacy, Immutability, Transparency.

SUBJECTIVE ANSWER SCRIPT EVALUATION USING MACHINE LEARNING

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ABSTRACT

Evaluation of subjective answer scripts is a time-consuming and often inconsistent process due to human bias and variability in assessment. This paper proposes a Machine Learning (ML)-based system for automated evaluation of subjective answers to improve accuracy, consistency, and efficiency in the grading process. The proposed model utilizes Natural Language Processing (NLP) techniques to analyze student responses by comparing them with reference answers and evaluating semantic similarity, keyword relevance, and contextual correctness. Various ML algorithms, such as Support Vector Machines (SVM), Random Forest, and deep learning models, are employed to extract meaningful features and predict scores based on predefined grading criteria. The system is trained on a dataset of evaluated answer scripts to learn scoring patterns and ensure fair assessment. Additionally, the model can provide feedback on student responses, helping learners understand areas of improvement. Experimental results demonstrate that the proposed system achieves reliable performance comparable to human evaluators while significantly reducing evaluation time. This approach can be effectively integrated into digital learning platforms and examination systems to enable scalable and unbiased assessment of subjective answers.

Keywords: Machine Learning, Subjective Answer Evaluation, Automated Grading, Natural Language Processing (NLP), Text Similarity, Semantic Analysis, Educational Data Mining, Artificial Intelligence, Essay Scoring, Smart Evaluation System. An AI/ML-Based Intelligent Farming and Gardening Assistant for Plant.

DISEASE DETECTION AND PESTICIDE RECOMMENDATION

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ABSTRACT

The integration of Artificial Intelligence (AI) and Machine Learning (ML) in agriculture has significantly enhanced precision farming and smart gardening practices. This paper presents an AI/ML-based Intelligent Farming and Gardening Assistant designed to identify plant diseases using image-based analysis and recommend appropriate pesticide solutions. The proposed system leverages deep learning techniques, particularly Convolutional Neural Networks (CNNs), to analyze plant leaf images and accurately detect diseases at early stages. The system is trained on a diverse dataset of healthy and diseased plant images, enabling robust classification across multiple crop types. Once a disease is identified, the assistant provides targeted pesticide recommendations, along with usage guidelines, to assist farmers and home gardeners in effective crop management. The model aims to reduce crop loss, minimize excessive pesticide usage, and promote sustainable agricultural practices. Additionally, the system can be integrated into mobile or IoT-based platforms for real-time disease monitoring and decision support. Experimental results demonstrate high accuracy in disease detection, making the proposed system a reliable and scalable solution for smart agriculture and gardening applications.

Keywords: *Artificial Intelligence, Machine Learning, Smart Agriculture, Plant Disease Detection, Image Processing, Deep Learning, Convolutional Neural Network (CNN), Precision Farming, Pest Management, Sustainable Agriculture, Smart Gardening, Crop Health Monitoring.*

NUTRIENT BASED GROCERY AND FOOD SERVICES

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ABSTRACT

The project titled “Nutrient-Based Grocery & Food Services” focuses on transforming the way people select and consume food by integrating personalized nutrition with modern technology. In today’s fast-paced lifestyle, individuals often struggle with confusing dietary information, lack of time for meal planning, and difficulty in choosing healthy food options, which leads to unhealthy eating habits and increased health risks. To overcome these challenges, this project proposes an intelligent platform that uses Artificial Intelligence (AI) and machine learning to provide personalized food and grocery recommendations based on a user’s health profile, dietary preferences, allergies, and wellness goals. The system collects and analyzes user data to generate nutrient-optimized meal plans, smart shopping lists, and suitable product suggestions through an integrated grocery platform. It also includes features such as profile creation, real-time progress tracking, and adaptive recommendations to ensure continuous improvement in health outcomes. By utilizing a large database of food products and recipes, the platform ensures accurate, efficient, and user-friendly services accessible through mobile and web applications. This solution simplifies decision-making, reduces effort, and promotes healthier eating habits by making nutrition more accessible, affordable, and personalized. Furthermore, research indicates that personalized nutrition improves adherence to healthy diets and lowers the risk of chronic diseases, highlighting the effectiveness of this approach. Overall, the project bridges the gap between nutritional science and everyday food choices, offering a scalable and practical solution to enhance individual health and well-being through technology-driven innovation.

Keywords: *Personalized Nutrition, Artificial Intelligence (AI), Machine Learning, Health Profile, Dietary Preferences, Nutrient Optimization, Smart Grocery System, Meal Planning, Food Recommendations, Data Analysis, User Interface, Mobile Application, Wellness Goals, Chronic Disease Prevention, Healthy Lifestyle.*

INTELLIGENT HOME HEALTH MONITORING

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ABSTRACT

The Intelligent Home Health Monitoring system is enhanced using a hybrid deep learning framework that combines Convolutional Neural Networks (CNN) and Long Short-Term Memory (LSTM) networks for more accurate and continuous health prediction. CNN layers are employed to automatically extract complex patterns from multi-modal sensor data, including wearable devices and IoT-enabled medical equipment, while LSTM layers capture temporal dependencies to track changes in vital signs over time. This hybrid model supports advanced prediction features such as early detection of arrhythmias, blood pressure anomalies, and oxygen saturation drops, along with forecasting potential health risks based on historical trends. Real-time anomaly detection triggers immediate alerts to residents, caregivers, or healthcare providers, ensuring prompt intervention during critical conditions. The system also offers personalized health recommendations, medication reminders, and adaptive emergency response protocols. Data augmentation and normalization techniques improve model robustness under varying sensor conditions. A secure cloud-based infrastructure ensures reliable storage, remote access, and integration with telemedicine platforms for continuous care. Quantitative evaluation using accuracy, precision, recall, and F1-score demonstrates significant improvement in prediction performance compared to traditional machine learning models. This hybrid CNN-LSTM approach provides a scalable, intelligent and proactive health monitoring solution, enhancing elderly care, chronic disease management, and overall quality of life in smart homes.

Keywords: *Intelligent Home Health Monitoring, Hybrid Deep Learning, CNN-LSTM, IoT Healthcare, Wearable Devices, Real-time Monitoring, Anomaly Detection, Predictive Healthcare, Telemedicine, Smart Homes*

CRYPTO CURRENCY PRICE PREDICTION USING QUANTUM MACHINE LEARNING: A HYBRID VARIATIONAL APPROACH

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ABSTRACT

Cryptocurrency markets are characterized by extreme non-linearity, high volatility, and complex temporal dependencies, which pose significant challenges to traditional machine learning (ML) models. This paper proposes a Hybrid Quantum-Classical Machine Learning (HQCML) framework for forecasting cryptocurrency prices, with a primary focus on Bitcoin (BTC) and Ethereum (ETH). The proposed framework combines classical data preprocessing techniques—such as normalization, feature extraction, and noise reduction—with quantum feature encoding methods to efficiently represent financial data in a quantum state space. A Variational Quantum Circuit (VQC) is employed as the core predictive model and is trained using a gradient-free optimization approach to address issues such as barren plateaus in quantum training. In addition to the VQC, two other quantum models—Quantum Support Vector Machine (QSVM) and Quantum Neural Network (QNN)—are implemented and evaluated for comparative analysis. Experiments are conducted using historical OHLCV (Open, High, Low, Close, Volume) data collected from CoinMarketCap, covering the period from 2017 to 2024. Simulations are performed using Qiskit's AerSimulator to emulate quantum circuit behavior on classical hardware. The experimental results demonstrate that the proposed QNN model outperforms other quantum and classical baselines, achieving a Mean Absolute Error (MAE) of 154.6, Root Mean Square Error (RMSE) of 198.3, and a directional prediction accuracy of 94.1%. These findings highlight the potential of quantum-enhanced machine learning models to capture complex financial patterns more effectively than classical approaches, thereby establishing HQCML as a promising direction for high-frequency cryptocurrency price forecasting and future financial analytics.

Keywords: Cryptocurrency Forecasting, Hybrid Quantum-Classical Machine Learning (HQCML), Variational Quantum Circuit (VQC), Quantum Neural Network (QNN), Quantum, Support Vector Machine (QSVM), Bitcoin (BTC), Ethereum (ETH), Time Series Prediction.

AI-BASED HAZARDOUS SOUND DETECTION SYSTEM FOR INDUSTRIAL ENVIRONMENTS USING MACHINE LEARNING

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ABSTRACT

Industrial environments are inherently noisy, making it extremely difficult to detect critical and potentially life-threatening sounds such as gas leaks, electrical sparks, mechanical failures, or human distress signals. Traditional monitoring systems rely solely on visual inspections or chemical-based sensors, which are limited in scope and often fail to provide real-time response. The Noise Guardian project proposes an intelligent, AI-powered sound detection and classification system capable of monitoring factory audio streams in real time.

Using advanced machine learning algorithms and spectral signal analysis, the system automatically distinguishes between normal operational noise and anomalous or hazardous sounds. Upon detection of a dangerous event, instant alerts are dispatched to the control room and designated safety personnel, enabling swift intervention and potentially preventing accidents, injuries, or fatalities.

Keywords: *Sound Classification, Machine Learning, Industrial Safety, Real-Time, Alerts, Spectral Analysis, Deep Learning.*

CIVIC RESOLVE: AN AI-DRIVEN WEB PLATFORM FOR CIVIC ISSUE RESOLUTION

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ABSTRACT

Civic Resolve is a full-stack, AI-powered web platform designed to improve civic complaint management and support digital governance in Tamil Nadu. It provides a centralized interface for citizens to register, track, and manage issues related to public services such as roads, sanitation, drainage, and electrical infrastructure. The system overcomes limitations of traditional grievance mechanisms by offering a transparent, accessible, and efficient solution. Built using a Flask backend, SQLite database, and a React-based frontend, it ensures seamless user interaction. An integrated machine learning model automatically classifies complaints and routes them to appropriate departments, achieving an accuracy of 87.5%. The platform also features a bilingual interface (Tamil and English) and demonstrates improved usability and efficiency in civic issue resolution.

Keywords: *SQLite database, sanitation, drainage, React.*

AN ASYNCHRONOUS CYBER SECURITY TOOL FOR SUB DOMAIN ENUMERATION AND NETWORK INTELLIGENCE GATHERING

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ABSTRACT

In the modern digital landscape, cybersecurity plays a critical role in protecting interconnected systems from increasingly sophisticated threats. As web infrastructures grow in complexity, the need for scalable and automated reconnaissance tools becomes essential. This research presents, a Python-based tool designed to automate subdomain enumeration and network reconnaissance to support early vulnerability identification. The tool integrates passive data collection from public sources and certificate transparency logs with brute-force techniques for comprehensive subdomain discovery. It performs DNS resolution with wildcard detection to reduce false positives, CNAME inspection for subdomain takeover analysis, Web Application Firewall (WAF) detection through behavioral and header analysis, HTTP probing extracts status codes, headers, and server configurations, and Nmap-based port and service scanning on resolved IPs. the tool ensures high-speed performance across large scale domains. In benchmark testing on high-traffic domains like Google, Tool achieved 95% subdomain discovery accuracy and 100% precision (no false positives), completing the scan in just 11 minutes. These results demonstrate the tool's efficiency, reliability, and practical value for real-world penetration testing and attack surface mapping. The work highlights the importance of fast, accurate, and automated reconnaissance solutions and offers a foundation for future enhancements through AI-driven vulnerability correlation and real-time threat analytics.

Keywords: Subdomain Enumeration, Passive and Brute-force Reconnaissance, Cybersecurity Automation, DNS/WAF/HTTP/Nmap Integration.

SMART SEO: A MACHINE LEARNING FRAMEWORK FOR AUTOMATED SEARCH ENGINE OPTIMIZATION

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ABSTRACT

In the modern digital landscape, cybersecurity plays a critical role in protecting interconnected systems from increasingly sophisticated threats. As web infrastructures grow in complexity, the need for scalable and automated reconnaissance tools becomes essential. This research presents SmartSEO, a Python-based machine learning framework designed to automate and democratize search engine optimization for small businesses and individual content creators. The system integrates natural language processing techniques with intelligent optimization algorithms. SmartSEO employs a hybrid approach combining TF-IDF, Sentence-BERT embeddings, and graph-based ranking for effective keyword extraction. It also features an ensemble intent classification system using Multinomial Naive Bayes and Decision Tree algorithms to categorize search intent. A linear regression model predicts search engine rankings based on content quality, structure, and engagement metrics. The framework performs multi-stage content analysis including preprocessing, readability assessment, heading optimization, and metadata enhancement. The modular design supports integration with CMS platforms and third-party APIs. Experimental evaluation on 500 samples showed 89.7% accuracy in intent classification, 78.5% precision in keyword extraction, and strong ranking prediction ($R^2 = 0.74$). Case studies demonstrated up to 120% increase in organic traffic and 67.4% improvement in rankings. The system reduces manual effort by 68% and improves visibility by 42%. SmartSEO supports digital inclusion and aligns with Sustainable Development Goals 8, 9, and 10, providing a scalable foundation for future enhancements such as multilingual support and AI-driven optimization.

Keyword: *Extraction, Intent Classification, Ranking Prediction, Content Optimization, Digital Visibility.*

TRANSFORMER-BASED NUTRITION ESTIMATION AND PERSONALIZED DIET RECOMMENDATION USING DEPTH SENSING

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ABSTRACT

Accurate dietary monitoring is essential for preventing lifestyle-related diseases; however, existing nutrition tracking systems rely heavily on manual food logging, which is time-consuming and error-prone. This paper proposes an intelligent and automated framework that integrates image-based nutrition estimation with personalized diet recommendation using deep learning techniques. The proposed system consists of two main modules: a nutrition estimation module and a diet recommendation module. In the first module, food items are automatically recognized from images using transformer-based deep learning models, while depth sensing techniques are utilized to estimate portion size and volume. The identified food and estimated quantity are then mapped to a standard nutrition database to compute key nutritional values such as calories, proteins, carbohydrates, and fats. In the second module, user-specific parameters including age, Body Mass Index (BMI), and health conditions are analyzed to generate personalized diet plans using a hybrid rule-based recommendation engine. The system also provides an interactive dashboard for visualizing nutrient intake and recommended dietary guidelines. Experimental results demonstrate that the proposed approach improves the accuracy of nutrition estimation and enhances user experience through automated analysis and explainable recommendations. The integrated framework supports real-time health monitoring and promotes healthier lifestyle choices, making it suitable for practical healthcare and wellness applications.

Keywords: *Deep Learning, Food Image Recognition, Nutrition Estimation, Personalized Diet Recommendation, Depth Sensing, Vision Transformer, Computer Vision, Healthcare Analytics, Body Mass Index (BMI), Intelligent Dashboard*

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AN EDGE-INTELLIGENCE-ENHANCED IOT FRAMEWORK FOR ADAPTIVE MEDICATION ADHERENCE MONITORING WITH PREDICTIVE CLOUD ANALYTICS

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ABSTRACT

Medication non-adherence remains a critical challenge in chronic disease management, contributing to over 125,000 preventable deaths and \$300 billion in avoidable healthcare costs annually in the United States alone. To address this, this paper introduces the Smart Medical Pill Box, an innovative Internet of Things (IoT)-based healthcare system designed to automate medication reminders and remotely monitor patient adherence through a secure cloud platform. Built around an ESP32 microcontroller, the device utilizes integrated LEDs, a buzzer, and a pushbutton to effectively manage medication schedules and confirm patient intake. Visual and audio alerts are triggered to remind patients, while the confirmation via the pushbutton instantly transmits adherence data to the cloud platform for real-time remote monitoring. The prototype successfully demonstrated reliable scheduling, accurate alerting, and robust cloud synchronization. Ultimately, the Smart Medical Pill Box offers a low-cost, scalable, and user-friendly solution with significant potential to enhance medication adherence, particularly for elderly and chronically ill populations.

A LAYERED MULTI-ALGORITHM ADAPTIVE TRAFFIC SIGNAL CONTROL FRAMEWORK FOR CLOUD-EDGE INTELLIGENT TRANSPORTATION SYSTEMS WITH EMERGENCY VEHICLE PRIORITY

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ABSTRACT

A key limitation of the traditional fixed-time signal systems is that it is a major contributor to urban traffic congestion. They are not able to react to variable traffic conditions. The proposed supervisory controller is the Adaptive State-Aware Signal Controller (ASAC), which is presented in this paper. It actively alternates five complementary traffic control strategies depending on the real-time traffic state classification. ASAC employs the transparent five-layer decision model that consists of traffic state classification, threshold-based control, queue-aware green time optimization, PID-based stabilization, and the choice of the supervisory strategy. This model is elaborated in 18 equations of mathematics. Fifteen traffic signal control algorithms were used to support and validate ASAC using 480 SUMO simulation runs. These runs included three traffic demand conditions (400, 700 and 1000 veh/hr) with ten random independent seed runs of each condition. The findings indicate that there is no best algorithm that fits all traffic conditions. ASAC has competitive waiting time in every situation. It also has the highest throughput during high demand at approximately 2150 veh/hr. Moreover, it has the most uniform distribution of performance among all seeds. This proves ASAC to be a stable and consistent controller that requires no training data or machine learning. Further research will aim at expanding the ASAC framework to multi-junction control, where neighboring ASAC processes coordinate phase decisions to eradicate the propagation of stop-and-go waves through arterial directions. Detectors based on IR sensors will be enhanced to edge-mounted cameras to count vehicles in order to provide a more precise estimation of the queue. The emergency priority system will be expanded to assist the GPS-based forecasting green corridors development, pre-clearing several sequential junctions before an emergency vehicle approaches. Lastly, the framework shall be tested under mixed traffic conditions that are related to the Indian city roads, including two-wheelers and non-motorized cars, to determine performance under the mixed traffic conditions other than the homogeneous arrival model applied in the present study.

SYNOPSIS TOOL BASED AREA OPTIMIZED POWER AMPLIFIER FOR UWB MEDICAL APPLICATIONS

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ABSTRACT

The design and performance analysis of a Class-A Common-Emitter RF Power Amplifier utilizing Synopsys Custom Compiler in 14 nm FinFET CMOS technology are presented in this work. The amplifier is intended for ultra-wideband (UWB) medical and Internet of Things (IoT) communication systems operating in the 3.1–10.6 GHz band. A shunt-shunt and current-reuse feedback network increases gain without using more DC power. The design achieves ~18 dBm Psat, ~8% PAE, and ~10 dB small-signal gain. Optimal matching is confirmed by return losses of $S_{11} < -30$ dB and $S_{22} < -20$ dB. The 14 nm FinFET implementation validates deep-submicron CMOS scaling for tiny biomedical RF front-ends by outperforming previous 90 nm and 65 nm CMOS designs in gain, power dissipation, and chip area.

POST-MONSOON VARIATION ANALYSIS OF VAIGAI DAM WATER SPREAD AREA USING SAR DATA (OCT–DEC 2025) BASED ON SATELLITE IMAGE PROCESSING (REMOTE SENSING)

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ABSTRACT

Effective monitoring of seasonal reservoir dynamics is essential for sustainable water resource management, particularly during the post-monsoon period when storage levels peak and operational decisions are critical. Traditional optical remote sensing methods using Multispectral Scanner (MSS) data often face limitations due to cloud cover, atmospheric interference, and limited revisit frequency, which can compromise timely and accurate water extent estimation. This project leverages Synthetic Aperture Radar (SAR) data from the Copernicus Programme (Sentinel-1 mission) of the European Space Agency (ESA) to analyze temporal variations in the water spread area of Vaigai Dam located at Theni District during October, November, and December 2025. The SAR datasets provide all-weather, day-and-night imaging, overcoming key constraints of classical optical techniques. A rigorous preprocessing workflow using the Sentinel Application Platform (SNAP) software was implemented. This process consists of orbit file application, thermal noise removal, radiometric calibration, speckle filtering, and Range-Doppler terrain correction, ensuring geometrically accurate and quantitatively reliable VH-band backscatter data. Water body extraction was performed using backscatter thresholding, exploiting the low backscatter characteristics of water surfaces. The analysis revealed that the water spread area increased from 20.38 km² in October to 21.75 km² in November, corresponding to monsoonal inflows, and then decreased sharply to 15.77 km² in December due to reduced inflow and anthropogenic water use. The study demonstrates the effectiveness of SAR-based methods in capturing dynamic Vaigai Dam reservoir behavior. This study will support actionable insights for irrigation planning and reservoir management, while highlighting the potential for scalable, cloud-independent hydrological monitoring across diverse regions.

AIR POLLUTION MONITORING USING SENTINEL SATELLITE DATA -A CASE STUDY FOR MADURAI DISTRICT, SOUTH INDIA

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ABSTRACT

Air pollution is the contamination of the atmosphere by harmful substances such as gases, particles, and chemicals. Air pollution is a major environmental and public health issue, especially in rapidly growing cities like Madurai, where industrial activity and vehicular emissions are increasing. Traditional air pollution monitoring methods, such as ground-based stations, provide limited spatial coverage, accurate local data but have limitations including high cost. These drawbacks make it difficult to capture complete regional pollution patterns in cities like Madurai. This Project proposes a satellite-based approach using Sentinel-5P TROPOMI data to analyse multiple pollutants including NO₂, SO₂, CO, O₃, CH₄, and HCHO in Madurai region. The data is pre-processed through temporal filtering, averaging, and spatial extraction for the study area. All pollutant values are normalized and combined into a unified multi-pollutant index, which is classified into five levels from very low to very high pollution. The proposed method offers advantages such as wide spatial coverage, cost-effectiveness, and the ability to detect pollution hotspots. Results show higher pollution levels in Madurai urban and traffic-dense regions in the city. The model demonstrates accuracy in identifying spatial pollution trends, making it suitable for large-scale monitoring, environmental planning, and decision-making.

DETECTION AND MONITORING OF INLAND WATER BODIES USING MULTITEMPORAL SAR DATA

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ABSTRACT

Monitoring and Mapping inland water bodies is essential for sustainable water resource management, agriculture, and disaster management. Conventional field surveys and optical remote sensing techniques used for waterbodies monitoring are limited by cloud cover, night-time conditions, coarse spatial resolution, and high operational costs, which restrict their effectiveness for continuous large-area monitoring. To overcome these limitations, this study proposes an automated inland waterbody mapping and monitoring approach using multitemporal Sentinel-1 Synthetic Aperture Radar (SAR) data, which enables all-weather, day-and-night observations at a high spatial resolution of 10 m. The methodology utilizes Google Earth Engine and Google Colab for efficient SAR data preprocessing, including radiometric calibration, speckle filtering, terrain correction, and spatial clipping. Inland water bodies are extracted using VV&VH backscatter values and threshold-based classification technique, followed by multitemporal analysis to assess seasonal and long-term variations in water extent. Madurai District, Tamil Nadu, is selected as the study area, and Sentinel-1 SAR data from 2020 to 2025 are analyzed to generate year-wise water body maps. Finally, an intersection analysis of the year-wise water body maps (2020–2025) is performed to identify common and persistent water bodies, highlighting long-term stable water resources within the study area.

Keywords: Sentinel-1 SAR, Inland Water Mapping, Multitemporal Analysis, Change Detection

GIS-BASED SAMPLING SITE SELECTION METHOD FOR EVALUATING THE IMPACT OF CHECK DAMS

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ABSTRACT

Water conservation structures such as check dams play a vital role in reducing soil erosion and enhancing water availability in semi-arid regions. However, evaluating all constructed or planned check dams is time-consuming and resource-intensive, especially in large watershed projects. This study proposes a GIS-based sampling site selection methodology to identify representative check dam locations for future evaluation. A total of 63 check dams are planned in the study area, and 10% (6 check dams) are selected as samples using a weighted multi-criteria approach. The selection criteria include village proximity within 500 meters, vegetation condition using Normalized Difference Vegetation Index (NDVI) derived from Sentinel-2 imagery, and spatial positioning of villages categorized as upstream, midstream, and downstream. Spatial analysis such as buffer generation and village identification was performed using QGIS Software (Ver. 3.44) and supported by Google Satellite imagery 2026. Weightage values were assigned to each criterion, and final selection was carried out using an Excel-based scoring system. The proposed approach ensures spatial representation and reduces evaluation complexity of impact of check dams while maintaining analytical reliability.

Keywords: Check Dams, GIS, NDVI, Remote Sensing, Multi-Criteria Analysis, Watershed Management

SATELLITE-BASED SEASONAL SOIL MOISTURE ANALYSIS FOR AGRICULTURAL MANAGEMENT IN MADURAI USING SENTINEL-1 DATA

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ABSTRACT

Soil moisture monitoring is essential for enhancing agricultural productivity and promoting sustainable use of natural resources. Traditional approaches, such as field sampling and laboratory testing, are time-consuming, labor-intensive, and unsuitable for large-scale and real-time monitoring. To overcome these limitations, this work employs Microwave Remote Sensing (MRS) data, which provides high-resolution observations under all weather conditions, including cloudy and low-light environments. This study proposes a remote sensing-based method to estimate soil moisture using Sentinel-1 satellite imagery for the Madurai region. In addition, a seasonal analysis was performed using data from January, March, May, June, September, and November to capture temporal variations in soil moisture. The interaction of microwave signals with soil moisture enables effective estimation through backscatter analysis. The methodology involves acquiring Sentinel-1 Ground Range Detected (GRD) data and preprocessing it in SNAP software, including speckle filtering and terrain correction. VV and VH polarization backscatter values are extracted to compute a normalized soil moisture index. The results are presented as thematic maps classifying soil moisture into high, medium, low, and very low categories. For November, analysis shows that 28% of the area falls under high moisture, 34% medium, 25% low, and 13% very low. This approach enables large-area coverage, reduced manual effort, and improved irrigation management.

Keywords: *Soil Moisture Estimation, Sentinel-1 SAR, Microwave Remote Sensing, VV/VH Polarization, Backscatter Coefficient, Terrain Correction, Seasonal Analysis*

IOT-BASED SMART ENERGY METER WITH PREPAID RECHARGE SYSTEM

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ABSTRACT

Efficient energy management and accurate billing are critical challenges in modern power distribution systems. Conventional electricity meters rely on manual readings and postpaid billing, which often lead to human errors, delayed payments, and energy misuse. This paper presents the design and implementation of an IoT-based Smart Energy Meter with a Prepaid Recharge System to address these limitations. The proposed system integrates a microcontroller-based energy metering unit with IoT connectivity to enable real-time monitoring of electricity consumption. The collected data is transmitted to a cloud platform, allowing users to access usage details and balance status through a web or mobile interface. A prepaid billing mechanism is incorporated, where users must recharge their account in advance. The system continuously deducts the consumed energy cost from the available balance and provides low-balance alerts to the user. In cases of zero balance, the system automatically disconnects the power supply and restores it upon recharge. The solution enhances transparency, reduces electricity theft, eliminates manual intervention, and encourages efficient energy utilization. Owing to its low cost and scalability, the system is well-suited for residential and small-scale applications.

AN ENERGY-AWARE HYBRID MULTI-HOP AND MULTIPATH ROUTING APPROACH FOR IMPROVED NETWORK LIFETIME IN WSNs

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ABSTRACT

Wireless Sensor Networks (WSNs) are widely used in applications such as environmental monitoring, smart agriculture, and industrial automation, where continuous and reliable data transmission is essential. However, energy constraints in battery-powered sensor nodes often lead to uneven energy consumption, early node failure, and reduced network lifetime. To address these challenges, this work proposes a hybrid approach by combining HYMN (Hybrid Multi-hop Routing) and EEMCL (Energy-Efficient Multi-Cluster with Multipath Routing) to achieve efficient and balanced communication. The system consists of multiple sensor nodes organized into dynamic clusters, where Nodes Band C act as cluster heads (CHs) based on residual energy. Data is sensed periodically and transmitted efficiently to the sink through optimized routing paths. HYMN enables multi-hop communication between nodes, while EEMCL supports multipath routing, allowing data to be forwarded through different paths such as $A \rightarrow C \rightarrow F \rightarrow \text{Sink}$ and $B \rightarrow C \rightarrow \text{Sink}$. This multipath strategy ensures that traffic is evenly distributed across the network. As a result, data is delivered efficiently to the sink while avoiding overload on specific nodes, preventing early energy depletion. Additionally, dynamic cluster head rotation and continuous energy tracking improve overall energy utilization. Simulation results demonstrate improved reliability, balanced load distribution, and extended network lifetime, making the proposed system suitable for energy-constrained WSN environments.

WEARABLE FALL DETECTION USING MACHINE LEARNING

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ABSTRACT

Falls are a major health risk for elderly individuals and patients with mobility issues. Rapid detection of falls can significantly reduce injury severity and improve emergency response time. This paper proposes a real-time fall detection system using inertial sensor data. Falls represent a significant health risk for elderly individuals and patients with mobility impairments, often leading to severe injuries, prolonged hospitalization, and increased mortality rates. Early and accurate detection of fall events is therefore critical to enable timely medical intervention and reduce the overall impact on patient health and quality of life. This work proposes a robust real-time fall detection system based on inertial sensor data acquired from an accelerometer and gyroscope, capturing the dynamic motion characteristics of human activities. The proposed approach utilizes a hybrid deep learning architecture that integrates Convolutional Neural Networks (CNN) and Gated Recurrent Units (GRU) to effectively model both spatial and temporal patterns in motion signals. The CNN component is responsible for extracting discriminative local features such as sudden acceleration changes and impact patterns, while the GRU component captures temporal dependencies and sequential motion transitions associated with fall events. This combination enables the system to accurately differentiate between falls and Activities of Daily Living (ADL), addressing limitations of traditional threshold-based and machine learning approaches.

The model is trained using the publicly available SisFall dataset, which provides a comprehensive collection of simulated fall scenarios and daily activities, ensuring diverse motion representations. To evaluate generalization capability and real-world applicability, the trained model is further validated using the MobiFall dataset, demonstrating its robustness across different subjects and motion conditions. For practical deployment, the trained model is implemented on a Raspberry Pi 5, enabling real-time inference using live IMU sensor inputs. The system is optimized to maintain low computational complexity and efficient memory usage, making it suitable for edge-based wearable applications. Experimental results indicate that the proposed system achieves high accuracy in distinguishing fall events from non-fall activities, while minimizing false alarms. Overall, the proposed solution offers a scalable and efficient approach for real-time fall detection, with potential applications in elderly healthcare monitoring, smart wearable systems, and assisted living environments. Future enhancements include multi-sensor fusion with physiological signals and integration with IoT-based alert systems for automated emergency response.

SOIL AND PLANT ANALYZER DEVELOPMENT (SPAD) VALUE PREDICTION BY COMBINING CNN FEATURES WITH CHLOROPHYLL-SENSITIVE COLOUR FEATURES WITH DYNAMIC DATA UPDATE

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ABSTRACT

The most reliable non-invasive field measure of crop nitrogen condition is leaf chlorophyll concentration, but the commercial devices that can quantify it correctly are still unaffordable to most small holder paddy farmers in South and Southeast Asia. The present paper proposes a two-pathway regression model to predict continuous SPAD value using standard RGB photos taken with a standard digital camera, where photos of individual leaves are given first priority, but broad leaf crop photos that accumulate naturally over time through field implementation are also welcomed. A single pathway takes individual images and processes them using a small three-block convolutional neural network, which encodes spatial pigmentation gradient, vein geometry, and localised chlorosis texture of the leaf lamina. The second route calculates nine deterministic colour descriptors – illumination-normalised RGB channel means, HSV chromatic elements, and the Dark Green Colour Index – which contain agronomically validated chlorophyll-predictive signal entirely independent of any learned representation. Both outputs are joined by feature-level concatenation and mapped to a SPAD estimate by a two-layer dense regression head trained under Huber loss with the Adam optimiser. Base training runs for 80 epochs on the initial annotated corpus. An inference-time dynamic update mechanism automatically appends each newly processed image and its predicted label to a growing CSV registry, triggering automatic 80-epoch warm-start retraining at every 50-sample increment, with overall model accuracy rising monotonically as the rice-prioritised corpus expands through deployment. The complete pipeline is delivered through Leaf Sense Precision Agriculture AI, a multilingual Streamlit web application accessible from any smartphone browser. Benchmarked against four baseline models on an 850-sample corpus prioritised on rice leaf images, the proposed Hybrid CNN achieves RMSE=7.07 SPAD units, MAE=5.50 SPAD units, and a classification accuracy of 80.84% – the best result across every evaluated metric.

ADVANCED UART CONTROLLER WITH FIFO BUFFER AND DMA INTEGRATION ON APB BUS

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ABSTRACT

The project presents the design and implementation of an AMBA AXI4 DMA (Direct Memory Access) Controller aimed at achieving high-performance data transfers between memory and peripheral devices. The DMA controller is designed to deliver low latency, high throughput, and efficient resource utilization. The target performance metrics include a latency of less than 50 nanoseconds, a throughput of up to 1 Gigabyte per second, and a compact hardware footprint with a maximum utilization of 10% of the available LUTs (Lookup Tables) on the target FPGA. Additionally, the design is optimized for power efficiency, with an expected power consumption of less than 500 milliwatts. The critical path delay of the DMA controller is targeted to be less than 5 nanoseconds, ensuring seamless integration and operation within the overall system. The goal of this project is to develop a versatile and high-performance DMA controller that can significantly offload the CPU and enhance the overall system performance in a wide range of embedded and real-time applications.

Keywords: *AMBA, AXI4, DMA, Direct Memory Access, Controller, Data Transfers, Low Latency, High Throughput, Resource Utilization, FPGA, Lookup Tables, Power Efficiency, Power Consumption, Critical Path Delay, Embedded Applications, Real-Time Application*

ADAPTIVE DEEP NEURAL NETWORK FRAMEWORK USING TCAM-DRIVEN AUTOENCODER AND GA OPTIMIZATION FOR ENERGY-CONSTRAINED EDGE DEVICES

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ABSTRACT

The exponential growth of complex, high-dimensional data in fields like genomics, finance, and multimedia necessitates highly efficient and intelligent compression techniques. Traditional autoencoders (AEs) provide a powerful framework for unsupervised data encoding and decoding by learning compressed latent representations. However, their performance is critically dependent on the meticulous design of their architecture and hyperparameters—a process often mired in manual tuning and suboptimal convergence. This paper proposes a novel hybrid model that synergistically integrates a Deep Neural Network (DNN)-based Autoencoder with a Genetic Algorithm (GA) for optimized data encoding and decoding. The enhanced autoencoder serves as the core feature extractor, learning non-linear dimensionality reductions, while the genetic algorithm operates as an intelligent meta-optimizer. The GA automates the search for the optimal neural architecture—including the number of layers, neurons, and activation functions and fine-tunes critical hyperparameters such as learning rate and regularization strength. This evolutionary approach navigates the vast search space more effectively than grid or random search, mitigating the risk of local minima and fostering the discovery of robust, high-performing models. Empirical evaluations on benchmark datasets demonstrate that the proposed GA-optimized autoencoder significantly outperforms standard, manually configured autoencoders in reconstruction fidelity, compression efficiency, and the quality of the learned latent space.

Keywords: *High-Dimensional Data, Compression Techniques, Autoencoders, Deep Neural Network, Genetic Algorithm, Data Encoding, Dimensionality Reduction, Hyperparameter Tuning, Benchmark Datasets.*

DESIGN AND IMPLEMENTATION OF A DRAM-BASED PROCESSING-IN-MEMORY (PIM) ACCELERATOR FOR CNN INFERENCE USING APPROXIMATE COMPUTING

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ABSTRACT

The performance of modern AI and machine learning workloads is increasingly bottlenecked by the energy and latency costs of data movement between processing units and main memory—a problem known as the "memory wall." Processing-in-Memory (PIM) is an emerging paradigm that mitigates this by integrating computation directly within memory arrays. However, implementing area-intensive arithmetic units like multipliers in commodity DRAM technology is a significant challenge. This project proposes a novel, DRAM-compatible PIM architecture for accelerating Convolutional Neural Network (CNN) inference. The core innovation is the replacement of traditional multipliers with hardware-efficient, shifter-based approximate multipliers. This approach drastically reduces the area, power, and design complexity, making it feasible for integration into dense DRAM arrays. This work presents the Verilog design, simulation, and analysis of a PIM-enabled memory bank controlled by a dedicated CNN controller. The system is designed to perform convolution operations with high energy efficiency and low area overhead, while demonstrating that the use of approximate computing results in a negligible loss of prediction accuracy, making it a viable solution for edge AI and data center acceleration.

Keywords: AI, Machine Learning, Memory Wall, Processing-in-Memory, DRAM, Convolutional Neural Network, Approximate Multipliers, Energy Efficiency, Verilog Design, Edge AI.

ENHANCING HOME AUTOMATION THROUGH NATURAL LANGUAGE UNDERSTANDING AND REAL-TIME IOT COMMAND MAPPING

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ABSTRACT

Building smart home systems that are aware of their surroundings is now feasible thanks to the quick development of Internet of Things (IoT) and artificial intelligence (AI) technologies. This project presents an IoT-integrated AI voice assistant that uses straightforward, natural language to carry out automated tasks. The system is built in Python and uses Google Gemini for speech recognition, natural language comprehension, and decision-making in addition to LiveKit, a cloud-based communication server. The assistant can conduct internet searches, send emails automatically, provide weather updates, and let users create custom wake words for individualized communication. It interacts with an ESP8266 microcontroller to use preprogrammed commands to control Internet of Things devices like LED lights. With the use of command mapping and machine learning, real-time device control is made possible, enabling customizable brightness modes such as rainy mode (75%) and movie lighting (15%). Through text-to-speech conversion, the system produces fluid voice responses, offering an affordable, adaptable, and intelligent smart assistant that improves automation, customization, and remote access in smart environments.

Keywords: *Artificial Intelligence (AI) Personalized Automation, Internet of Things (IoT) IoT Device Control AI Voice Assistant Voice Commands Smart Home Automation, ESP8266 Machine L*

LIGHTWEIGHT DEEP LEARNING MODEL FOR REAL-TIME MULTI-CLASS LUNG DISEASE DETECTION USING CHEST X-RAY IMAGES

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ABSTRACT

Recent global health crises, particularly the spread of COVID-19, have emphasized the need for fast and dependable diagnostic solutions. Conventional testing approaches such as RT-PCR can be time-intensive and may produce varying results depending on testing conditions. To address these challenges, this study investigates the use of chest X-ray imaging combined with deep learning methods for effective identification of lung diseases. In this work, an enhanced Convolutional Neural Network model, referred to as EfficientCovNet+, is developed to improve feature extraction from radiographic images. The proposed model incorporates attention-based mechanisms along with optimized activation functions to better capture relevant patterns in lung regions. It is designed to distinguish between multiple respiratory conditions, including COVID-19, viral pneumonia, and lung opacity, which often present with similar clinical characteristics. To strengthen the model's performance, various data preprocessing strategies such as augmentation and noise reduction are applied. The system is trained using a large and diverse set of chest X-ray images, enabling it to perform reliably across different scenarios. Experimental evaluation shows that the proposed approach achieves higher accuracy and faster prediction compared to standard CNN-based methods. In addition to improving classification performance, the model is designed with practical deployment in mind. Its ability to deliver quick results makes it suitable for real-time applications, particularly in settings with limited medical resources. This approach can support healthcare professionals by enabling earlier diagnosis, reducing classification errors, and assisting in effective patient management.

Keywords: Chest Radiography, Lung Disease Detection, Deep Learning, Medical Image Classification, Automated Diagnosis.

EFFICIENT DRONE-ASSISTED IOT-BASED COOPERATIVE COMMUNICATION SYSTEM FOR SMART TRAFFIC MONITORING IN 5G NETWORKS

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ABSTRACT

Rapid urbanization has increased traffic congestion, requiring intelligent monitoring solutions. This project proposes a drone-assisted cooperative communication system integrating embedded platforms with the Internet of Things (IoT) for real-time traffic monitoring. Unmanned aerial vehicles (UAVs) equipped with sensors and communication modules collect traffic data such as vehicle density and congestion. These drones act as mobile relay nodes, enabling Device-to-Device (D2D) communication to enhance coverage and reduce latency. Data is processed using edge computing and transmitted over 5G networks to cloud platforms for analysis. The system provides real-time traffic insights, alerts, and route optimization. Overall, the solution is scalable, energy-efficient, and suitable for smart city applications, demonstrating the integration of embedded systems, IoT, UAVs, and 5G technologies.

Keywords: Drone-Assisted Communication, Embedded Systems, Internet of Things (IoT), Unmanned Aerial Vehicles (UAVs), Device-to-Device (D2D) Communication, 5G networks, Edge Computing, Smart Traffic Monitoring, Real-Time Data Analytics, Smart City Applications.

ADAPTIVE SATELLITE COMMUNICATION SYSTEM USING DYNAMIC BANDWIDTH ALLOCATION AND RAIN ATTENUATION MITIGATION

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ABSTRACT

Satellite communication systems are widely used for long-distance communication, broadcasting, and remote connectivity. However, their performance is significantly affected by environmental factors such as rain attenuation and inefficient bandwidth utilization. This project proposes an adaptive satellite communication system that dynamically allocates bandwidth and mitigates signal degradation caused by atmospheric conditions. The system continuously monitors channel conditions such as signal-to-noise ratio (SNR) and weather parameters. Based on these inputs, it adjusts modulation schemes and bandwidth allocation in real time to maintain reliable communication. During adverse weather conditions, particularly in higher frequency bands like Ku and Ka, adaptive techniques such as power control and coding are applied to reduce signal loss. Simulation and implementation can be carried out using MATLAB or Python to model satellite links and analyze performance improvements. The proposed system enhances communication efficiency, reduces data loss, and ensures quality of service (QoS) in satellite-based networks

Keywords: *Ellite Communication, Rain Attenuation, Adaptive Modulation, Bandwidth Allocation, Signal-to-Noise Ratio (SNR), Ku Band / Ka Band, Quality of Service (QoS), Link Optimization, Wireless Communication*

IOT PLATFORM FOR ROAD SURFACE ANALYSIS USING MEMS DATA AI BASED FAULT DETECTION SYSTEM

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ABSTRACT

In smart cities, ensuring road safety and optimizing transportation efficiency heavily relies on streamlined road condition monitoring. The application of Artificial Intelligence (AI) has notably enhanced the capability to detect road surfaces effectively. For the smooth operation of daily commutes, asphalt pavement issues are the primary concern of both developing and developed nations. Numerous studies have been conducted on the detection of potholes, which pose a danger to automobiles and passengers and have the potential to cause an accident. The purpose of this work is to investigate the potential of deep learning models and implement three exceptional deep learning models for pothole detection on edge devices. A low-cost system for real-time detection of road pavement surface conditions is proposed in this work. In order to obtain data regarding the state of the road surface, the time-frequency domain processing of the inertial signals that are provided by on-car sensors is carried out. High classification rates indicate that the proposed system is effective at identifying the type and presence of distress. The data collected from the road surfaces are then analysed using machine learning algorithms, such as Multi-Layer Perceptron (MLP). The results demonstrate the effectiveness of the proposed method in accurately identifying different road conditions. From these results, it was observed that the MLP provides better accuracy of 98.98% in assessing road conditions. The study provides valuable insights into the development of a more efficient and reliable road condition monitoring system for delivering secure transportation services in smart cities.

Keywords: *IoT (Internet of things), MEMS (Microelectromechanical systems), Road surface analysis, Ai based Fault detection, Vibration sensors, Machine learning, Data Acquisition.*

FIRE ACCIDENTS - AVOIDANCE SYSTEM IN EV VEHICLE

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ABSTRACT

Electric vehicles (EVs) are gaining widespread adoption due to their environmental benefits and energy efficiency. However, fire hazards associated with lithium-ion batteries, thermal runaway, and electrical faults remain critical safety concerns. This paper proposes a fire accident avoidance system for EVs that integrates real-time monitoring, early fault detection, and automated response mechanisms. The system utilizes temperature sensors, gas sensors, and battery management system (BMS) data to identify abnormal conditions such as overheating, short circuits, and gas emissions. Advanced algorithms analyze these parameters to predict potential fire risks and trigger preventive actions, including power cutoff, thermal management activation, and user alerts. Additionally, IoT-based communication enables remote monitoring and emergency notifications. The proposed system enhances vehicle safety, reduces the likelihood of fire incidents, and improves overall reliability of electric vehicles. This approach contributes to safer EV adoption by addressing one of the most significant challenges in modern electric mobility.

Keywords: *Electric Vehicles (EVs), fire accident prevention, lithium-ion battery safety, thermal runaway detection, battery management system (BMS), gas sensors, temperature monitoring, IoT-based safety system, fault detection, and smart vehicle safety.*

EMPOWERS BLIND PEOPLE THROUGH AI-AND IOT-DRIVEN VISION FOR INCLUSIVE MOBILITY

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ABSTRACT

IoT-based assistive technology designed to address the challenges faced by individuals with visual impairments, aiming to enhance their daily lives and mobility. This proposed project employs smart sensors and a deep learning-based Region Convolutional Neural Network (RCNN) to facilitate safe navigation and human recognition. Many visually impaired individuals encounter obstacles in their surroundings, and this application utilizes object detection to identify items ahead, offering a real-time auditory output for safe navigation. Additionally, the proposed system incorporates a face recognition feature that enables users to recognize Known and unknown person individuals through voice-based assistance. In emergency situations, IoT technology facilitates swift and automated emergency calls, enabling rapid response and assistance by seamlessly connecting devices to emergency services. The Faster Region Convolution Neural Network technique is employed to process and classify images captured by the device's camera, with the detected information relayed as audio feedback. By combining automation, object detection, and face recognition, this innovative model provides visually impaired individuals with a more comfortable and efficient means of navigating their environment compared to traditional aids like white canes. This technology represents a promising step towards improving the independence and quality of life for those with visual impairments.

Keywords: *Microcontroller, Esp32-Cam, Ultrasonic Sensor, Buzzer, Battery, LCD Display, Power Supply*

IOT INTEGRATED HIDDEN KEYPAD DESIGN FOR ATM USER PRIVACY

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ABSTRACT

ATM PIN theft through shoulder surfing is a serious security issue, as traditional ATM keypads are visible and can be easily observed by attackers. Existing measures like CCTV cameras cannot fully prevent PIN exposure. This project proposes an IoT-Based Invisible Keypad for ATM Privacy to enhance security. It uses an RFID reader (MFRC522) for card authentication, an ultrasonic sensor (HC-SR04) to ensure proper user positioning, and an IR sensor to detect nearby intruders. If any unauthorized presence is detected, the keypad becomes invisible to prevent PIN theft. A dynamic shuffled keypad is generated using a Python-based GUI, changing layout each time to prevent pattern and smudge attacks. User data and hashed PINs are securely stored in a MySQL database. The system supports banking operations such as deposit, withdrawal, balance enquiry, mini statement, and OTP-based PIN change. Overall, the system combines IoT technology, encryption, and dynamic UI design to provide a cost-effective and practical solution for improving ATM privacy and security. Keywords: IoT, Invisible Keypad, ATM Security, Shoulder Surfing Prevention, RFID Authentication, Ultrasonic Sensor, IR Sensor, Dynamic Keypad Shuffling, PIN Encryption, Python, MySQL.

REAL TIME ADAPTIVE TRAFFIC LIGHT CONTROL USING EDGE COMPUTING AND COMPUTER VISION FOR VEHICLE DETECTION

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ABSTRACT

The study presents a real-time adaptive traffic light control system using edge computing and computer vision for efficient urban traffic management. Conventional traffic signal systems operate on fixed timing mechanisms and fail to respond to dynamic traffic conditions, leading to increased congestion and vehicle delay. This research aims to develop an intelligent and responsive system that can monitor, analyze, and control traffic signals based on real-time conditions. The proposed system utilizes roadside cameras and edge computing devices to capture and process live traffic data. A YOLO-based deep learning model is employed for accurate detection and classification of multiple vehicle types under complex traffic scenarios. Traffic density is estimated using the Passenger Car Equivalent (PCE) method, which considers the varying impact of different vehicles on road space. Based on this estimation, an adaptive traffic light control algorithm dynamically adjusts signal timings to optimize traffic flow and prevent lane starvation. Experimental results show that the system achieves up to 33% reduction in traffic congestion by minimizing vehicle accumulation at intersections and a 23% decrease in average waiting time by optimizing signal allocation in real time. The system operates efficiently on resource-constrained edge devices, reducing latency and eliminating continuous cloud dependency. The proposed approach is cost-effective, scalable, and suitable for smart city applications, with future enhancements including multi-intersection coordination and emergency vehicle prioritization. Keywords: Adaptive Traffic Control, Edge Computing, Computer Vision, YOLO, Traffic Density Estimation, Passenger Car Equivalent (PCE), Smart Traffic Systems, Real-Time Monitoring, IoT, Urban Traffic Management.

MANAGING O-RAN NETWORKS WITH ARTIFICIAL INTELLIGENCE, MACHINE LEARNING AND NEW ENERGY INTEGRATION

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ABSTRACT

The rapid evolution of wireless communication has led to the emergence of Open Radio Access Network (O-RAN) architecture, which introduces openness, flexibility, and interoperability into traditional network infrastructures. Managing O-RAN networks efficiently presents significant challenges due to the dynamic nature of traffic patterns, resource allocation, and energy consumption. This research explores the integration of Artificial Intelligence (AI) and Machine Learning (ML) techniques to enable intelligent and autonomous management of O-RAN networks. The proposed framework leverages AI/ML algorithms for real-time network optimization, including traffic prediction, interference management, and adaptive resource scheduling across distributed network components. Furthermore, this study investigates the incorporation of new and renewable energy sources into the O-RAN ecosystem to address growing energy demands and promote sustainable network operations. Experimental evaluations demonstrate that the AI/ML-driven approach significantly improves network performance, reduces operational costs, and enhances energy efficiency compared to conventional management strategies. The findings highlight the potential of intelligent automation and green energy integration in building scalable, resilient, and environmentally sustainable next-generation O-RAN networks.

Keywords: O-RAN, Open Radio Access Network, Artificial Intelligence, Machine Learning, Energy Integration, Network Optimization, Resource Management, Sustainable Networks, 5G.

SECURE COMMUNICATION USING QUANTUM CRYPTOGRAPHY

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ABSTRACT

This presentation explores the transformative potential of quantum cryptography in revolutionizing secure communications. Moving beyond the mathematical complexities of classical cryptography, Quantum cryptography harnesses the fundamental principles of quantum mechanics to establish unbreakable security. We will delve into the core concepts of Quantum Key Distribution (QKD), the most prominent application, elucidating how the laws of quantum physics, such as the Heisenberg uncertainty principle and the no-cloning theorem, enable the secure generation and distribution of cryptographic keys. Furthermore, the presentation will highlight the intrinsic ability of QKD to detect any eavesdropping attempts, offering a significant advantage over traditional methods. While acknowledging current limitations such as range and infrastructure requirements, we will discuss the unique benefits of quantum cryptography, including its future-proof security against quantum computing threats. The project simulates a basic QKD protocol (BB84) using Qiskit, IBM's quantum computing framework, and demonstrates how quantum states can be used to exchange encryption keys securely. Finally, we will touch upon potential applications across various sectors demanding the highest levels of data protection, paving the way for a future of truly secure communication networks.

A NEXT-GENERATION ROAD SURFACE DETECTION SYSTEM FOR ADAS

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ABSTRACT

The Photonic Road Surface Scanner (PRSS) is an advanced sensing system designed to improve road condition detection in Advanced Driver Assistance Systems (ADAS). It uses photonic technology to emit light onto the road surface and analyze the reflected signals. Different road conditions such as dry, wet, icy, or rough surfaces produce unique spectral patterns. These signals are processed using intelligent algorithms to identify surface conditions in real time. The detected information can assist vehicle systems like traction control, braking, and stability management. PRSS enhances driving safety by enabling vehicles to respond more effectively to changing road environments.

FARM FUSION PREDICTION USING MACHINE LEARNING

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ABSTRACT

Farm fusion refers to the strategic integration of different farming components, including crop rotation, livestock, irrigation, soil management, and resource allocation, aimed at maximizing productivity and sustainability. Machine learning (ML) has emerged as a transformative tool in this domain, enabling predictive analytics that support data-driven decision-making in modern agriculture. This abstract explores the deployment of ML models to predict outcomes of farm fusion techniques such as mixed cropping, organic-inorganic synergy, and sustainable resource usage. The prediction process leverages diverse datasets, including historical yield data, meteorological patterns, soil nutrient profiles, irrigation logs, and satellite imagery. Algorithms such as Random Forest, Support Vector Machines (SVM), Gradient Boosting, and Deep Neural Networks are trained to analyze these multi-dimensional datasets. The integration of IoT sensors and remote sensing technologies enables real-time data collection, which is crucial for updating models dynamically and providing accurate, actionable insights. The fusion prediction models are evaluated using performance metrics such as accuracy, RMSE, and precision-recall to validate their reliability. Results demonstrate the models' capability to identify patterns and predict future outcomes related to crop yield, pest outbreak risks, and optimal planting cycles. Additionally, unsupervised learning techniques like clustering help segment farms based on productivity, resource efficiency, and sustainability, aiding policy-makers and agri-tech firms in targeted intervention. In conclusion, machine learning-based farm fusion prediction systems empower farmers with enhanced foresight, reduce environmental impact, and promote smart farming practices. The fusion of data and ML not only revolutionizes agriculture but also plays a critical role in addressing global food security and climate resilience challenges.

FUTURE COMMUNICATION AND 6G OF WIRELESS TECHNOLOGIES

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ABSTRACT

The standardization activities of the fifth generation communications are clearly over and deployment has commenced globally. To sustain the competitive edge of wireless networks, the next generation of wireless communication systems (namely, sixth generation, (6G)) aimed at laying the foundation for the stratification of the communication needs of the 2030s. In support of this vision, this study highlights the most promising lines of research from the recent literature in common directions for the 6G project. In India 6G future direction is defined by Bharat 6G vision documents published in 2023. Its core contribution involves exploring the critical issues and key potential features of 6G communications, including: (i) vision and key features; (ii) challenges and potential solutions; and (iii) research activities. It defined by ITU-R M-2160 with terahertz (300-3000 GHz) unlike microwave bands in 5G that remains uncertain and limited by cost.

Keywords: *Edge, 6G, terahertz, microwave*

AUTOMATIC VEHICLE NAVIGATION USING LIDAR

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ABSTRACT

This study investigates the application of Light Detection and Ranging (LIDAR) technology for automatic vehicle navigation. Autonomous navigation systems face significant challenges in real-time obstacle detection, path planning, and environmental mapping. LIDAR-based systems offer high-precision distance measurement and 360-degree environmental sensing, making them suitable for autonomous vehicle applications. This research aims to explore the integration of LIDAR sensors with navigation algorithms to enable reliable and efficient vehicle guidance. Experimental investigations involve the implementation of LIDAR-based perception modules combined with control systems for obstacle avoidance and route planning. Structural analyses, including sensor data processing, point cloud generation, and navigation accuracy testing, are conducted to evaluate system performance under various environmental conditions. The findings provide insights into the behaviour of LIDAR-guided navigation systems, facilitating the development of effective autonomous driving strategies and improving the reliability of such systems in real-world engineering applications.

Keywords: *Autonomous Navigation, LIDAR, Point Cloud, Obstacle Detection, Path Planning, Vehicle Navigation System.*

DESIGN AND FABRICATION OF HOVERBOARD USING MAGNETIC LEVIATION

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ABSTRACT

This project presents the design and analysis of a personal transportation system integrating both conventional and advanced magnetic levitation concepts to achieve efficient and stable mobility. The system explores a hybrid approach combining a low-cost electric hoverboard structure with principles of superconducting magnetic levitation for future scalability. The proposed model consists of a three-wheeled electric hoverboard platform driven by a simple motorized mechanism controlled using a DPDT switch for forward and backward motion. A stabilizing auxiliary wheel is incorporated to maintain balance, eliminating the need for complex sensors such as gyroscopes and accelerometers, thereby reducing cost and system complexity. In parallel, the study investigates the feasibility of implementing High-Temperature Superconductors (HTS), specifically Yttrium Barium Copper Oxide (YBCO), to achieve frictionless levitation using Electrodynamic Suspension (EDS). The system leverages the Meissner Effect and Flux Pinning phenomena to maintain stable levitation over a Permanent Magnet Guideway (PMG), addressing stability limitations described by Earnshaw's Theorem. Analytical evaluation focuses on achieving sufficient levitation force and guidance force to support practical payload conditions. Thermal management considerations include the use of a cryogenic cooling system with liquid nitrogen to maintain superconducting conditions below critical temperature. Simulation studies are performed to analyze magnetic field damping and system stability. The overall design aims to provide a scalable pathway from a cost-effective ground-based hoverboard prototype to an advanced, frictionless, zero-emission urban mobility solution.

Keywords: *Magnetic Levitation (Maglev), Hoverboard, High-Temperature Superconductors (HTS), YBCO, Electrodynamic Suspension (EDS), Meissner Effect, Flux Pinning, Cryogenics, Liquid Nitrogen (LN₂), Permanent Magnet Guideway (PMG), Urban Mobility, Electric Vehicle, Stability Analysis*

EMBEDDED WITH IOT IN CLOUD COMPUTING

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ABSTRACT

The study investigates the integration of Internet of Things (IoT) with Cloud Computing to build a robust, scalable, and intelligent infrastructure for real-time data collection, processing, and storage. IoT devices generate vast amounts of data from sensors and connected systems, while cloud computing provides the necessary computational power and storage capacity to handle such large-scale data effectively. This research aims to explore the interplay between IoT and cloud platforms to enhance system performance and optimize resource utilization. Experimental investigations involve deploying IoT-enabled devices interfaced with cloud services, followed by detailed characterization of the resulting architecture. Structural analyses, including network performance evaluation, latency measurement, data security assessment, and scalability testing, are conducted to assess the system quality and performance under various operational conditions. The findings provide insights into the behaviour of IoT-cloud integrated systems, facilitating the development of effective deployment strategies and improving the reliability of such systems in real-world engineering and smart applications.

Keywords: *Internet of Things (IoT), Cloud Computing, Real-time Data Processing, Scalability, Network Performance, Smart Systems, Resource Optimization.*

IOT ENABLED SMART BLACKBOX FOR AUTOMOBILES POWERED BY ARMCORELTEX M3 CORE PROCESSOR

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ABSTRACT

Nowadays automobiles technologies are rapidly increase each and every year and also every second accident count also increases. So, while using some technologies like black box places in automobile means creating a new level of data service in vehicle. The automobile black box has functions similar to an airplane black box. It is highly useful to analyse the cause of vehicular accidents and prevent the loss of life and property arising from vehicle accident these paper presents the prototype automobile black box system it is having the group of sensor and also gives the black box sends an alert message to pre stored mobile number in the way2sma in the case of an accident.

Millions of people die due to accidents. The vehicle accident is a major public problem in many countries. This problem is still increasing due to rider's rash driving and drunk and drive. This problem can be solved by using Black Box system analysis. Automobiles and computer technologies are creating a new level of data service in vehicles. It is used to analyse the cause of vehicular accident and prevent the loss of life and property analyse the cause of vehicle accident. This project proposes a prototype of an automatic Black Box.

Keywords: *Automobile Black Box, Accident Detection, Vehicle Data Recorder, GSM, GPS, Sensor Integration, Emergency Alert System, Embedded Systems, Road Safety, IoT.*

PERFORMANCE OPTIMIZATION OF IRS-AIDED COOPERATIVE WIRELESS COMMUNICATION SYSTEMS

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ABSTRACT

The evolution of 5G and upcoming 6G communication systems has increased the demand for intelligent and energy-efficient wireless technologies. Intelligent Reflecting Surfaces (IRS) have emerged as a promising solution for controlling electromagnetic wave propagation through programmable phase shifts. This work presents the design and analysis of a 4×1 microstrip patch antenna array operating at 2.4 GHz for IRS-assisted communication. The antenna was designed and validated using ANSYS HFSS and CST Studio Suite to evaluate key parameters such as gain, radiation pattern, and return loss. Analytical evaluation of Bit Error Rate (BER) under varying conditions demonstrates that IRS integration significantly enhances signal quality and communication reliability. The proposed system supports beam steering and phase control for improved coverage and reduced interference. Future work will incorporate Deep Neural Network (DNN)-based optimization for adaptive beamforming. This study provides a foundation for intelligent, reconfigurable wireless systems in next-generation communication networks.

Keywords: *Intelligent Reflecting Surfaces, Microstrip Patch Antenna Array, Beam Steering, BER, 5G/6G, Deep Neural Network.*

ELECTRICAL AND ELECTRONICS ENGINEERING

MULTI-LAYER SECURITY SYSTEM FOR THEFT DETECTION USING GPS, RFID, AND FACE RECOGNITION

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ABSTRACT

This project proposes a Multi-Layer Security System for Theft Detection to improve the safety of vehicles and valuable assets. Conventional security systems are often limited in functionality and may fail to prevent unauthorized access effectively. To address this issue, the system integrates RFID authentication, face recognition, GPS tracking, and a vibration sensor, all controlled by an Arduino Mega. The RFID and face recognition modules ensure that only authorized users can access the system. In case of unauthorized access, an alarm is triggered and the engine is locked. The vibration sensor detects tampering attempts, while the GPS module provides real-time location tracking. This integrated approach offers a reliable, cost-effective, and intelligent solution for modern theft prevention and security monitoring.

Keywords: *Multi-Layer Security System, Theft Detection, Live Tracking.*

AN INTEGRATED HARDWARE AND SOFTWARE PLATFORM FOR ELECTROCHEMICAL DETECTION OF NITRATES IN WATER

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ABSTRACT

Water quality monitoring is essential for safeguarding public health and environmental sustainability. This work presents the development of an integrated hardware and software platform for electrochemical detection of nitrates in water. The system utilizes low-noise amplifier-based circuitry to capture precise electrochemical signals. A mobile application is developed to measure and display Open Circuit Potential (OCP) values in real time. Low-cost conductive screen-printed electrode strips are used for selective nitrate detection in water samples. The proposed system is compact, portable, and cost-effective, enabling rapid and on-site testing without the need for complex laboratory infrastructure. This platform provides a reliable solution for continuous water quality monitoring and can be applied in environmental monitoring, agriculture, and drinking water safety.

Keywords: *Electrochemical Sensor, Nitrate Detection, Open Circuit Potential, Water Quality Monitoring and Portable System.*

EV LOCKING SYSTEM USING ARDUINO UNO WITH RFID

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ABSTRACT

This project presents an Electric Vehicle (EV) locking system using RFID technology for enhanced security and ease of access. The system uses an RFID reader to detect authorized RFID tags and a microcontroller to verify user identity. Upon successful authentication, the vehicle locking mechanism is activated or deactivated. Unauthorized access is restricted, improving safety. The system is cost-effective, reliable, and eliminates the need for traditional keys, making it suitable for modern EV applications. The system is simple, low-cost, and eliminates the need for physical keys, providing a secure and efficient solution for EV access control.

Keywords: Vehicle security, smart locking system, wireless communication, and Embedded system.

PUBLIC INFRA STRUCTURE ISSUE REPORTING & RESOLUTION SYSTEM USING GENERATIVE AI

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ABSTRACT

Public infrastructure issues such as potholes, water leakage, and garbage accumulation pose significant challenges to urban development and public safety. Traditional complaint systems are often inefficient, lacking real-time tracking, automation, and proper prioritization mechanisms. This paper proposes a web-based Public Infra structure Issue Reporting and Resolution System integrated with Generative AI. The system allows citizens to report issues using images and location data, while AI automatically classifies the issue and generates structured complaint descriptions. Security is ensured using JWT authentication and SHA-256 hashing to prevent duplicate submissions. The system also includes a workflow management module that connects citizens, administrators, and field workers. The proposed solution improves efficiency, reduces manual effort, and supports smart city initiatives.

Keywords: *Generative AI, Smart City, Image Classification, Web Application, Civic Issue Reporting, JWT Authentication, MongoDB*

AIR OZONE BACTERIA REMOVER

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ABSTRACT

In recent times, airborne bacteria and microorganisms have become a major threat to human health, especially in indoor environments. Traditional air purification systems are not fully effective in removing harmful pathogens and often require high maintenance. To overcome these limitations, we propose an Air Ozone Bacteria Remover system. This system uses ozone (O₃) as a powerful oxidizing agent to eliminate bacteria, viruses, and other harmful microorganisms present in the air. The device is integrated with air quality sensors to continuously monitor environmental parameters such as particulate matter and ozone levels. Based on real-time sensor data, the system automatically controls ozone generation to ensure efficient sterilization while maintaining safe levels for human exposure. Additionally, IoT technology is incorporated to enable remote monitoring and control of the system, improving user convenience and operational efficiency. The proposed system is cost-effective, requires low maintenance, and provides an efficient solution for improving indoor air quality. It can be widely used in homes, hospitals, offices, and other enclosed spaces where maintaining clean and safe air is essential.

Keywords: Air purification, Ozone sterilization, IoT monitoring, Low maintenance and Indoor air quality.

INVESTIGATION OF DIELECTRIC BEHAVIOUR IN BINARY MIXTURES

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ABSTRACT

The determination of dielectric polarization is one of the most direct and promising methods that will give useful information regarding short-range interactions. The samples were purified by standard methods. Density was measured using 10 ml. R.D. bottle. Refractive index was measured using Abbe's refractometer. The temperature was maintained at 308K. The dielectric measurements were made with a digital VLCR-7meter. The following system: Ethyl bromide + Acetone in benzene were taken for the study. Also, dielectric properties are increasingly recognized as a decisive factor governing the electrochemical performance of super capacitor electrodes, as they directly influence charge storage capacity, charge discharge kinetics and columbic efficiency. Capacitors store energy in devices. The dielectric constant decides the amount of energy a capacitor can store. A larger constant means more storage of energy in less space. This parameter is crucial in Radar sensors. Hence, studies on dielectric materials are highly responsible for the modern world of electronics.

IOT-ASSISTED SMART SOLAR POWER UTILIZATION FOR EFFICIENT ELECTRIC VEHICLE CHARGING

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ABSTRACT

The rapid growth of electric vehicles(EVs) has increased the demand for sustainable and efficient charging solutions. Conventional EV charging systems rely heavily on grid power, which may originate from non-renewable sources and lead to increased energy costs and carbon emissions. This project proposes an IoT-assisted small solar power utilization system for efficient electric vehicle charging, integrating renewable energy, real-time monitoring, and intelligent control. The proposed system uses a solar panel as the primary energy source, monitored through voltage and current sensors interfaced with an ESP32 Microcontroller. A boost converter regulated by PWM ensures appropriate voltage levels for battery charging. Battery health, solar intensity, and power parameters are continuously Monitored and displayed on an LCD and transmitted through IoT for remote access. This approach enhances charging efficiency, reduces dependency on the grid, and promotes environmentally friendly EV charging infrastructure.

Keywords: *EV charging, Renewable Energy sources, Microcontroller and IoT.*

IOT BASED REMOTE SURVEILLANCE FOR ANIMAL TRACKING NEAR RAILWAY TRACKS

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ABSTRACT

Railway accidents caused by animals straying onto tracks are a significant safety concern in forest and rural regions. This project proposes an IoT-based intelligent surveillance system designed to detect and alert authorities about animal movement near railway tracks in real time. The system integrates computer vision and embedded IoT technology to enhance railway safety and prevent wildlife casualties. A webcam continuously monitors the railway track area, and live video is processed using Python with OpenCV for animal detection. Upon identifying the presence of an animal, the system sends a signal to an ESP32 microcontroller through a Wi-Fi network. The ESP32 acts as the central control unit, triggering multiple alert mechanisms such as an LCD display notification, buzzer alarm, and voice playback module connected to a speaker. Additionally, a motor driver (L298) can be used to activate warning mechanisms such as signal indicators near the track. The proposed system provides real-time monitoring, instant alerts, and remote communication capabilities, making it suitable for deployment in wildlife-sensitive railway zones. By combining IoT connectivity, image processing, and automated alert systems, this solution aims to reduce train-animal collisions, enhance railway safety, and contribute to wildlife conservation efforts.

Keywords: *ESP32 microcontroller, Webcam surveillance full time, Python with Open CV, L298 DC motor and Railway safety*

POWER QUALITY IMPROVEMENT USING INTERLEAVED CONVERTER FOR SOLAR EV APPLICATIONS

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ABSTRACT

The rapid growth of electric vehicles (EVs) has increased the need for efficient and sustainable charging systems. In this project, a solar-powered EV charging station is designed using an interleaved DC-DC converter to improve system efficiency and power quality. The system uses a photovoltaic (PV) source, which helps reduce dependence on conventional grid power and promotes clean energy usage. An interleaved converter is employed to reduce current ripple, minimize switching losses, and enhance overall performance compared to conventional converters. Its multi-phase structure also ensures better thermal distribution and improves system reliability, making it suitable for high-power EV charging applications. To extract maximum energy from the PV system under varying environmental conditions, a Maximum Power Point Tracking (MPPT) technique is implemented. In addition, appropriate control strategies are used to reduce total harmonic distortion (THD) and improve the power factor, thereby enhancing power quality. The proposed system is modeled and analyzed under different operating conditions. The results show that the system achieves improved efficiency, reduced ripple, and better power quality. Hence, it can be considered a reliable and eco-friendly solution for modern EV charging systems.

Keywords: *Interleaved DC-DC Converter, Maximum Power Point Tracking (MPPT), Electric Vehicles (EVs), Power Factor*

A REVIEW OF RECENT DEVELOPMENTS IN ENERGY RECOVERY AND HARVESTING TECHNOLOGIES FOR ELECTRIC AND FUEL CELL VEHICLES

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ABSTRACT

This review paper explores the significant role of energy harvesting and energy recovery techniques in the development of battery electric vehicles (BEVs) and fuel cell hybrid electric vehicles (FCHEVs), where the availability of onboard energy sources is inherently limited. Efficient utilization of harvested and recovered energy from various onboard systems can greatly enhance overall vehicle energy efficiency, extend driving range, and minimize fuel consumption. The review also discusses the growing potential of low-power and experimentally validated energy harvesting techniques for electric vehicle applications. Furthermore, the role of perception, navigation, and intelligent control technologies in autonomous vehicles is highlighted as a promising pathway to improve energy efficiency through optimized deceleration and route planning. Finally, the paper outlines key research gaps, existing challenges, and future opportunities in this rapidly evolving field. Compared with earlier review studies, this work offers a broader perspective by addressing often-neglected topics such as driver behavior, deceleration planning in autonomous vehicles, low-power harvesting approaches, and experimental methods relevant to modern electric vehicles.

Keywords: *Energy Storage Systems, Electric Vehicle Powertrain, Regenerative Braking Control Strategies and Driver Behavior Analysis*

ANALYSIS OF SOLAR POWERED ELECTRIC VEHICLES

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ABSTRACT

One of the key inhibitors to the purchase of Electric Vehicles (EVs) in most countries is range anxiety. EVs generally have a range between 100-200km on a full charge which is suitable for city driving but the same cannot be said for long distance highway driving. Using solar panels on an EV can help mitigate this problem as a typical solar panel might be able to supply sufficient amount of energy to the battery to ensure increased range by charging its battery pack during both during standstill and moving states. This paper aims to present the improvement in range that can be brought about by using solar photo-voltaic (PV) modules on an EV. The model has been developed and simulated in MATLAB/Simulink environment. The results demonstrate that PV module can charge the battery to a reasonable state of charge. Further, in order to portray the benefits offered by solar PV based EV, an energy benefit analysis has also been performed to highlight the achieved energy savings

Keywords: *Electric Vehicles (EVs), Range Anxiety, Solar Photovoltaic (PV) Systems, Solar-Powered Electric Vehicle, MATLAB/ Simulink Modeling and Battery State of Charge.*

HYBRID RENEWABLE ENERGY-BASED MICROGRID FOR RURAL ELECTRIFICATION

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ABSTRACT

Access to reliable electricity remains a significant challenge in many rural and remote areas due to the limitations of conventional grid extension. This paper proposes a hybrid renewable energy-based microgrid system designed to provide a sustainable and cost-effective solution for rural electrification. The proposed system integrates multiple renewable energy sources, including solar photovoltaic (PV) and wind energy, along with an energy storage system to ensure continuous power supply and improved system reliability. An intelligent energy management system is employed to optimize power generation, storage, and load distribution under varying environmental and demand conditions. The microgrid model is developed and analyzed using simulation tools to evaluate its performance in terms of energy efficiency, reliability, and economic feasibility. The results demonstrate that the hybrid microgrid system can effectively meet rural energy demands while reducing dependence on fossil fuels and minimizing environmental impact. This approach offers a promising pathway toward sustainable rural development and energy access.

Keywords: *Hybrid Renewable Energy System, Micro grid , Rural Electrification, Solar Photovoltaic (PV), Wind Energy, Energy Storage System, Energy Management System and Sustainable Energy.*

NEXT-GENERATION AUTONOMOUS HYBRID ELECTRIC VEHICLE USING AI AND IOT WITH SELF-CHARGING CAPABILITY

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ABSTRACT

The intersection of Artificial Intelligence (AI), Internet of Things (IoT), and smart energy systems is leading the path towards the next generation of autonomous mobility. This paper suggests the design and development of an AI- and IoT-based self-charging autonomous hybrid electric vehicle (HEV) with an integrated self-charging infrastructure. The car uses AI algorithms for route planning, decision-making, and energy management, and IoT facilitates real-time data exchange between the car, charging stations, and the grid. The self-charging infrastructure uses renewable energy harvesting (solar/wind), regenerative braking, and wireless charging to reduce the need for external charging networks. This serves to enhance vehicle range, reduce downtime, and promote eco-friendly transport. The conceptual framework depicts how autonomous HEVs with AI and IoT technologies can achieve energy independence, reduced carbon footprint, and intelligent mobility in smart cities of the future.

Keywords: *Autonomous Hybrid Electric Vehicle (AHEV), Smart Mobility, Artificial Intelligence (AI), Internet of Things (IoT), Self-Charging Infrastructure, Intelligent Energy Management and Sustainable Transportation.*

OVER VOLTAGE AND UNDER VOLTAGE PROTECTION SYSTEM

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ABSTRACT

This project presents an Over Voltage and Under Voltage Protection System designed to safeguard electrical appliances from grid fluctuations. Using a step-down transformer, rectifier, comparator IC (LM324), and relay module controlled by ESP32 microcontroller, the system continuously monitors mains voltage (220-240V AC). It automatically disconnects the load when voltage exceeds 260V or drops below 180V, with adjustable thresholds and 5-second delay to prevent nuisance tripping. An LCD display shows real-time status, while LEDs/buzzer provide alerts. This cost-effective solution enhances reliability beyond stabilizers for IoT-enabled renewable energy and embedded applications.

Keywords: *Overvoltage Protection, Under voltage Protection, Voltage Monitoring, ESP32 Microcontroller and Relay Switching*

OPTIMIZING INDUCTIVE WIRELESS POWER TRANSFER WITH DYNAMIC COIL ALIGNMENT AND ANSYS SIMULATION FOR ENHANCED EFFICIENCY

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ABSTRACT

Inductive wireless power transfer (IWPT) systems are increasingly used in applications ranging from electric vehicle charging to biomedical implants. However, their efficiency is highly sensitive to coil misalignment, which can significantly degrade power transfer performance. This study focuses on optimizing IWPT efficiency through dynamic coil alignment techniques combined with advanced electromagnetic simulation using ANSYS. A detailed model of a coupled coil system is developed and analyzed under varying lateral and angular misalignment conditions. Using ANSYS Maxwell, the magnetic field distribution, coupling coefficient, and power transfer efficiency are evaluated for different coil geometries and alignment strategies. A dynamic alignment mechanism is proposed, which adjusts the relative position of the transmitter and receiver coils in real time to maintain optimal coupling. Simulation results demonstrate that the proposed approach significantly improves efficiency compared to static configurations, reducing power loss and enhancing system reliability. The study also explores design trade-offs involving coil size, operating frequency, and alignment control sensitivity. The findings provide practical insights for designing robust and efficient IWPT systems, particularly in scenarios where perfect alignment cannot be guaranteed. Overall, this work highlights the importance of adaptive alignment and simulation-driven optimization in advancing next-generation wireless power technologies.

Keywords: *Inductive wireless power transfer, Biomedical implants and Power technologies.*

SEAMLESS WIRELESS POWER CHARGING FOR ELECTRIC VEHICLES: IOT-BASED STATUS MONITORING AND INTEGRATED PAYMENT SOLUTIONS

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ABSTRACT

Wireless power charging in EV stations with payment and IoT-based charging status indication is an innovative solution that combines wireless power transfer technology with payment and IoT-based systems to create a seamless and efficient EV charging experience. The wireless power transfer technology allows electric vehicles to charge without the need for a physical connection between the charging station and the vehicle. This technology utilizes electromagnetic induction or magnetic resonance to transfer power wirelessly from the charging station to the vehicle. To enable payment for the charging service, an online payment system can be integrated into the wireless charging station. This payment system can be linked to the user's account, and payment can be made through a mobile, App or website. The IoT-based charging status indication system can be used to provide real-time information on the status of the charging process. This system can monitor the charging progress, the amount of power consumed, and the estimated time remaining for the charging process to complete. The system can also alert users when the charging process is complete, enabling them to remove their vehicles and allowing other users to access the charging station. Overall, wireless power charging in EV stations with payment and IoT-based charging status indication is an advanced solution that provides a convenient, efficient, and seamless EV charging experience. It can help to increase the adoption of electric vehicles by making charging more accessible and user-friendly.

Keywords: *Wireless EV charging allows electric vehicles to charge without cables using electromagnetic power transfer. IoT-based monitoring with integrated online payment provides real-time charging status and enables a convenient, cashless charging experience.*

DRAINAGE INDICATOR

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ABSTRACT

Urban flooding due to drainage blockages remains a critical challenge in monsoon-prone cities like Chennai, causing property damage, traffic disruptions, and environmental hazards. This project presents an intelligent IoT-enabled system that revolutionizes drainage management through real-time monitoring, automated alerts, and predictive analytics. The proposed system integrates smart sensors, microcontrollers, and wireless communication technologies to continuously monitor key drainage parameters such as water level, flow rate, and blockages. Ultrasonic or water-level sensors are installed within drainage channels to detect rising water levels, while flow sensors measure the movement of water to identify potential clogs. Gas sensors can also be incorporated to detect hazardous gases such as methane in underground drainage systems, enhancing worker safety. which processes the collected data and transmits it to a cloud-based platform through Wi-Fi. In the event of abnormal conditions such as overflow or blockage, automated notifications are sent to municipal authorities or maintenance teams, enabling prompt intervention and reducing the risk of urban .The main purpose of the system is to prevent flooding, water logging, and environmental pollution.

Keywords: *Drainage Indicator, Water flow And Detect Blockages, Drainage System and Flooding.*

IOT BASED ENERGY MONITORING AND AUTOMATIC POWER FACTOR CORRECTION USING ARDUINO

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ABSTRACT

Energy monitoring facilitates quick access and helps to know the power utilization and normal and abnormal conditions. Now a days, many applications and majority industries face problems regarding power quality. In the power system, the power factor plays a vital role in power quality, the addition of capacitance over comes the decay of power factor and reduces the power loss. Our aim to build an Automatic Power Factor Correction (APFC) system, which can monitor the energy consumption of a system and automatically improve its power factor. In this design, an open-source energy monitoring library has been implemented for accurate power calculation. We carried out a work of hardware experimentation of energy monitoring and Automatic Power Factor Correction using a capacitor bank with the association of IOT technology. The result proves that designed Arduino energy monitoring and Automatic Power Factor Correction system out performs to improve the power factor without human interaction by properly switching the capacitor bank. Hence, the power loss, penalty and power quality related problems were resolved based on proposed approach. This design is compact, simple and easy to implement and aids in power system advancement.

Keywords: *Energy monitoring, Power Utilization, Power Loss and Automatic Power Factor Corrector*

ENHANCED LOW VOLTAGE RIDE THROUGH CAPABILITY OF GRID INTERFACED THREE PHASE SOLAR PV POWER PLANT

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ABSTRACT

The rapid integration of solar photo voltaic(PV) systems into power grids has introduced Challenges in maintaining grid stability and reliability, particularly in meeting Low-Voltage Ride-Through(LVRT)requirements that ensure PV power plants remain connected during Voltage dips or faults, since conventional grid-interfaced PV systems often disconnect under Low-voltage conditions causing power loss and reduced grid support therefore, this project Focuses on enhancing the LVRT capability of a three-phase grid-inter faced solar PV power Plant.

ARDUINO-DRIVEN BATTERY MANAGEMENT SYSTEM FOR ELECTRIC VEHICLE ENERGY OPTIMIZATION

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ABSTRACT

The rapid expansion of electric vehicles (EVs) and portable energy storage systems has intensified reliance on lithium-ion batteries. These batteries are highly sensitive to voltage, current, and temperature deviations, making dedicated Battery Management Systems (BMS) essential for safe operation. This paper presents the design and implementation of a low-cost, Arduino-based BMS for EV energy optimization. The system continuously measures voltage, current, and temperature using a voltage sensor module, ACS712 current sensor, and DS18B20 temperature sensor, respectively. An Arduino Uno microcontroller processes sensor data against predefined safety thresholds and, upon detecting fault conditions such as overcurrent, undervoltage, or overheating, automatically disconnects the load via a relay module. Real-time parameter visualization is provided through a 0.96-inch OLED display, and audible alerts are generated by an integrated buzzer. Experimental results confirm accurate fault detection, reliable load isolation, and stable real-time monitoring. The total implementation cost is approximately ₹1790, representing a 60–70% cost reduction compared to commercial BMS solutions. The proposed system is suitable for EV prototypes, educational laboratories, and research applications.

Keywords: Battery Management System; Arduino Uno; Lithium-ion Battery; Electric Vehicle; Overcurrent Protection; Undervoltage Protection; OLED Display; ACS712; DS18B20.

ADVANCED CONTACTLESS ENERGY TRANSFER FOR SMART DEVICES

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ABSTRACT

Advanced Contactless Energy Transfer (ACET), With the rapid expansion of smart devices and Internet of Things (IoT) applications, the demand for efficient, safe, and flexible power delivery mechanisms has significantly increased. This paper presents the design and analysis of an advanced contactless energy transfer system based on resonant inductive coupling, enabling efficient power transmission over short to moderate distances without physical connectors. The proposed system incorporates optimized coil design, compensation networks, and power electronic converters to enhance transmission efficiency and reduce energy losses. Additionally, it ensures user safety, minimizes electromagnetic interference, and supports multi-device charging. Experimental and simulation results demonstrate improved performance in terms of efficiency, reliability, and convenience compared to traditional charging methods. This technology offers promising applications in consumer electronics, biomedical implants, and electric mobility, paving the way for a truly wireless and sustainable energy ecosystem.

Keywords: *Wireless Power Transfer, Contactless Energy, Resonant Coupling, IoT and Smart Devices.*

AGGREGATION MODELING OF VSCS BASED ON PARAMETER IDENTIFICATION FOR POWER SYSTEMS WITH HIGH RENEWABLE PENETRATION

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ABSTRACT

This paper proposes a data-driven aggregation modeling framework that captures the dynamic behavior of inverter-based renewable energy sources using limited information on internal inverter controllers. The method utilizes admittance-based frequency response data obtained from frequency scanning to perform integrated gray-box parameter identification and equivalent modeling. In Stage 1, a hybrid identification algorithm combining particle swarm optimization (PSO) and enumeration is employed to estimate key voltage source converter (VSC) control parameters. In Stage 2, converters are grouped according to their current controller bandwidths, and representative parameters for each group are re-identified using aggregated frequency response data. The effectiveness of the proposed framework is validated through PSCAD/EMTDC simulations, demonstrating superior performance in frequency response accuracy and parameter estimation precision compared with the conventional averaging-based method. Quantitative evaluation shows that the hybrid PSO-enumeration algorithm substantially improves parameter estimation accuracy over PSO alone, producing results that closely match the reference parameter values. In multi-converter systems, the proposed cluster-based aggregation model reproduces both transient and steady-state behaviors with only small deviations from the non-aggregated model, whereas conventional averaging approaches exhibit significantly larger errors. These findings confirm the high fidelity and robustness of the proposed framework in representing heterogeneous converter dynamics. By relying solely on measured data and not requiring prior knowledge of internal controller structures, the proposed approach provides a practical and scalable solution for the analysis, simulation, and planning of renewable energy based distributed energy resources.

OPTIMAL DESIGN AND CONTROL OF HIGH POWER DENSITY BI-DIRECTIONAL CLLC CONVERTER WITH INTEGRATED TRANSFORMER FOR WIDE-RANGE EV BATTERY CHARGING

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ABSTRACT

This paper presents effective and practical control and design methodologies for electric vehicle (EV) on-board chargers (OBCs) utilizing bidirectional power factor correction (PFC) and CLLC resonant converters. The proposed system enables high-efficiency, high-power-density battery charging over a wide output voltage range from 320 V to 820 V. This is achieved by combining pulse frequency modulation (PFM) of the CLLC converter with dynamic DC-link voltage regulation through the PFC stage, ensuring optimal performance across varying operating conditions. A robust soft-start strategy is introduced that employs secondary-side pre charging of the CLLC stage and gradual activation of phase-shift modulation (PSM). This approach effectively limits inrush current, minimizes switching stress, and reduces electromagnetic interference (EMI) during startup, thereby enhancing overall system reliability. To improve power density and thermal performance, a compact integrated transformer design is proposed. The structure leverages inherent leakage inductance to eliminate the need for discrete resonant inductors and incorporates a center multi-gap and center-hole configuration to facilitate efficient heat dissipation. A systematic transformer design methodology is also presented to realize the desired gain characteristics while meeting thermal and dimensional constraints. The effectiveness of the proposed control and design techniques is validated through an 11 kW hardware prototype, achieving a peak efficiency of 96.7% and a power density of 1.5 kW/L. These results demonstrate the proposed approach's viability for wide-range, high-power battery charging applications in next-generation EV platforms.

V-SURF: VACUUM BASED SURFACE CLIMBING ROBOTIC SYSTEM

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ABSTRACT

This project presents the design and fabrication of a Wall Climbing Robot, a low-cost suction-based inspection robot. The robot is developed to perform inspection on vertical smooth surfaces where manual inspection is difficult, risky, and time-consuming. It uses a vacuum pump to create suction force, which helps the robot adhere to the wall surface. Two DC geared motors with wheels are used for movement, allowing the robot to climb vertically and move in different directions. The robot is controlled using an Arduino Nano, while an ESP32-CAM module is used for capturing images or live video for inspection purposes. A pressure sensor is included to monitor suction level and improve safety by stopping the robot if suction decreases. The complete structure is compact and can be fabricated using lightweight materials and 3D printed parts. The main objective of this project is to provide an affordable alternative to costly industrial inspection robots used in power plants, storage tanks, shipyards, and building maintenance. The proposed system demonstrates that wall-climbing robots can be developed at low cost with simple components while maintaining useful inspection capability. This project can be further improved in future by adding advanced sensors, artificial intelligence, and autonomous navigation features.

HAZARDS OF DC FAST CHARGING IN ELECTRIC VEHICLES

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ABSTRACT

DC fast charging technology plays a crucial role in the widespread adoption of electric vehicles by significantly reducing charging time. However, the high power levels involved in DC fast charging introduce several safety challenges and hazards. This study analyzes the potential risks associated with DC fast charging systems, including overheating, electrical faults, insulation failure, and stress on battery systems. The paper also examines the impact of high current flow on battery life, which may increase the chances of degradation and thermal instability if not properly controlled. Key safety considerations such as proper installation, grounding, cooling systems, and compliance with international standards are discussed. Furthermore, the role of advanced monitoring systems and protective mechanisms in minimizing risks is highlighted. This study aims to provide a clear understanding of the hazards associated with DC fast charging and suggests effective safety measures to ensure reliable and secure operation of EV charging infrastructure.

DESIGN AND IMPLEMENTATION OF BI-DIRECTIONAL CONVERTER FOR V2G AND G2V FOR HYBRID EV CHARGERS

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ABSTRACT

The increase in the electric vehicle mobility has encouraged the growth of vehicle to grid technology. The vehicle to grid technology allows bidirectional power flow between the battery of electric vehicle and grid. This allows peak load shaving, load levelling voltage regulation and improvement of power system stability. In this project we developed onboard bidirectional battery charger for Electric Vehicles (EVs) targeting Grid-to-Vehicle (G2V), Vehicle-to-Grid (V2G), and Vehicle-to-Home (V2H) technologies. During the G2V operation mode batteries are charged from the power grid with sinusoidal current and unitary power factor. During the V2G operation mode the energy stored in the batteries can be delivered back to the power grid contributing to the power system stability. In the V2H operation mode the energy stored in the batteries can be used to supply home loads during power outages, or to supply loads in places without connection to the power grid. Along the paper the hardware topology of the bidirectional battery charger is presented. Some considerations about the sizing of the AC side passive filter are considered to improve the performance in the three operation modes. The adopted topology and computer simulations and validated by experimental results achieved.

**DEPARTMENT OF
INFORMATION TECHNOLOGY**

BLOCKCHAIN AGAINST FAKE NEWS AND DEEP FAKES

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ABSTRACT

The rise of ubiquitous deepfakes, misinformation, disinformation, and post-truth, often referred to as fake news, raises concerns over the role of the Internet and social media in modern democratic societies. Due to its rapid and widespread diffusion, digital deception has not only an individual or societal cost, but it can lead to significant economic losses or to risks to national security. Blockchain and other distributed ledger technologies (DLTs) guarantee the provenance and traceability of data by providing a transparent, immutable, and verifiable record of transactions while creating a peer-to-peer secure platform for storing and exchanging information. This overview aims to explore the potential of DLTs to combat digital deception, describing the most relevant applications and identifying their main open challenges.

Keywords: Fake News, Disinformation, Deepfakes, Blockchain Technology, Distributed Ledger Technologies (DLT), Cybersecurity, Content Authentication, Digital Trust, Decentralized Verification, Threat Detection.

DEEP FAKE DETECTION USING DEEP LEARNING

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ABSTRACT

The exponential growth of digital media is responsible for rapid manipulation of visual content on an unprecedented scale, thereby creating significant challenges for the authenticity and security of such information. The emergence of artificial intelligence technologies is responsible for generating 'deepfakes,' or created media using social imagery and video that is sufficiently clever to evade conventional detection methods. This research aims to introduce a robust framework for detecting fraudulent and fabricated content using deep learning technology. The proposed framework includes a convolutional neural network (CNN) model, a deep learning technology known as a Resnet model, for extracting and learning complex features from images and video content. The features of images, such as irregularities on faces, changes in illumination, and unnatural blending, have been examined for distinguishing genuine from fraudulent content. The research utilizes conventional mathematical equations for refinement and accuracy. The CNN incorporated in this hybrid model is computationally efficient and enables the model to converge quickly. At the same time, it is reliable for various manipulation techniques and resolutions. The implications of this research aim to fortify the verification of digital content and provide a strong, scalable, and intelligent solution for the identification of deepfake media in various forms.

Keywords: Artificial Intelligence, Convolutional Neural Network, Deepfake Detection, Digital Forensics, Forgery Identification, Image Analysis, ResNet Architecture

AN AI-POWERED INTEGRATED SMART TRAFFIC MANAGEMENT AND SAFETY SYSTEM

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ABSTRACT

This project presents an AI-Powered Integrated Smart Traffic Management and Safety System, an intelligent urban mobility platform that combines real-time traffic monitoring, adaptive signal control, predictive analytics, automated violation detection, and environmental monitoring to improve road efficiency and public safety. The system operates as a closed-loop framework by collecting live data from CCTV feeds, IoT sensors, GPS-enabled vehicles, and historical datasets, analyzing traffic patterns using machine learning models, and dynamically optimizing traffic flow to reduce congestion and risk. Real-time vehicle detection enables adaptive signal timing, while GPS-based coordination creates automated green corridors for emergency vehicles. An AI-driven violation detection module using object detection and Automated Number Plate Recognition (ANPR) identifies infractions such as signal jumping and overspeeding, enabling instant e-challan generation. The platform also predicts congestion using historical and weather data, recommends alternate routes, manages smart parking availability, detects accidents, and monitors air quality for emission-aware traffic adjustments. Unlike conventional fixed-timer systems, the proposed solution employs data-driven, adaptive, and explainable AI supported by edge-cloud architecture for scalable, real-time performance. Overall, it functions as a unified smart traffic intelligence system that enhances safety, reduces emissions, and promotes sustainable urban mobility through continuous optimization.

Keywords: Smart Traffic Management, Computer Vision, Adaptive Signal Control, ANPR, Congestion Prediction, Accident Detection, IoT, Edge AI, Sustainable Urban Mobility

PYROPURE

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ABSTRACT

P*yroPure* is a portable air purifier built to handle smoke, toxic gases, and pollution – perfect for places hit by wildfires or stuck with bad air. It works in layers. First, a mesh filter grabs soot, ash, and fine particles like PM2.5. Then the air moves through an activated carbon filter packed with copper and manganese catalysts. This stage breaks down carbon monoxide and volatile organic compounds, turning them into safer stuff. After that, potassium permanganate on silica steps in, capturing and neutralizing acids and nasty gases like sulfur dioxide and nitrogen oxides. The last stage is actually pretty unique: a living layer of microalgae in agar-agar, which takes the carbon dioxide left over and converts it to oxygen through photosynthesis. That keeps the air cleaner while also making the whole system sustainable. There's more going on under the hood, too. PyroPure has built-in sensors and a microcontroller, so it automatically changes the fan speed depending on how smoky things get. It constantly checks air quality before and after it runs, so you can actually see it working in real time. The device is compact and modular. You can carry it by hand or attach it to a drone to clear the air in dangerous or out-of-the-way spots. PyroPure isn't just powerful – it's energy efficient, affordable, and easy to scale up. If you care about clean air and the environment, it's a smart choice.

Keywords: *Air Purification – PyroPure – Smoke Filtration – Activated Carbon – KMnO_4 – Microalgae – Adaptive Control – Air Quality Monitoring – Sustainable Technology*

REAL-TIME VIDEO ANOMALY DETECTION FOR BANK LOCKER SECURITY USING DEEP LEARNING

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ABSTRACT

The study investigates the development of an intelligent real-time surveillance system that automatically detects anomalous activities in bank locker rooms using Deep Learning and Computer Vision techniques. Traditional closed-circuit television surveillance systems rely entirely on human operators, which is inefficient and prone to error due to cognitive limitations and fatigue. This research proposes an automated AI-powered anomaly detection framework that continuously monitors video footage and generates immediate multi-channel alerts upon detecting threats. The system integrates a Convolutional Autoencoder deep learning model trained on the CUHK Avenue Dataset to learn normal behavioral patterns, and employs YOLOv8 for real-time detection of dangerous objects including knives, scissors, and suspicious items. Additional modules include frame-differencing motion detection and brightness/blur-based camera tamper detection. Upon anomaly detection, the system triggers an audio alarm and dispatches SMS notifications via the Twilio API while capturing timestamped evidence snapshots. Experimental evaluations demonstrate an overall detection accuracy of 91.33% with a false positive rate of 4.5%, maintaining real-time processing at 18-22 frames per second on standard CPU hardware. The proposed methodology draws on the TPR-VAD framework, adopting twice-reconstruction-based anomaly scoring principles for the bank locker security domain. The findings validate the effectiveness of the integrated deep learning approach in enhancing automated security surveillance while significantly reducing the dependence on continuous human monitoring.

Keywords: Real-Time Surveillance, Video Anomaly Detection, Deep Learning, Convolutional Autoencoder, YOLOv8, Bank Locker Security, Computer Vision, Twilio API, OpenCV, TensorFlow.

STRESS DETECTION SYSTEM USING FACIAL EXPRESSIONS WITH AUTOMATIC GAME RECOMMENDATION

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ABSTRACT

Stress has become a significant concern in modern society due to increasing workload, digital exposure, and lifestyle changes, necessitating efficient and accessible stress monitoring solutions. This paper presents the design and development of a real-time stress detection and management system based on facial expression analysis using computer vision and machine learning techniques. The proposed system captures continuous video input through a webcam and processes each frame to extract meaningful facial features without requiring any specialized hardware. For accurate facial feature extraction, the MediaPipe Face Mesh algorithm is employed to detect high-resolution facial landmarks, particularly around the eyes and mouth regions. Based on these landmarks, discriminative features such as Eye Aspect Ratio (EAR) and Mouth Aspect Ratio (MAR) are computed using geometric formulations to analyze eye blinking patterns and mouth dynamics, which serve as reliable indicators of psychological stress. Additionally, derived parameters such as blink rate are incorporated to enhance feature representation. Unlike conventional stress detection systems, the proposed approach integrates an adaptive stress management module that provides immediate intervention through relaxation-based interactive games. These include guided breathing exercises, focus-oriented activities, and slow-paced interactions designed to reduce cognitive load and promote emotional stability. The system dynamically recommends and activates appropriate relaxation techniques based on the detected stress level, thereby combining detection and mitigation within a unified framework. Experimental observations demonstrate that the system is capable of accurately detecting stress in real time and delivering effective relaxation interventions. The proposed solution is non-invasive, cost-effective, and user-friendly, making it suitable for applications in mental health monitoring, workplace wellness systems, and human-computer interaction environments.

Keywords: Stress Detection; Facial Expression Analysis; MediaPipe Face Mesh; Eye Aspect Ratio (EAR); Mouth Aspect Ratio (MAR); Random Forest Classifier; Computer Vision;

PLANT LEAF DISEASE RECOGNITION AND DETECTION USING DEEP LEARNING

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ABSTRACT

Plant disease diagnosis is very critical for agriculture due to its importance for increasing crop production. Recent advances in image processing offer us a new way to solve this issue visual plant disease analysis. However, there are few works in this area, not to mention systematic researches. In this paper, we systematically investigate the problem of visual plant disease recognition for plant disease diagnosis. Compared with other types of images, plant disease images generally exhibit randomly distributed lesions, diverse symptoms and complex backgrounds, and thus are hard to capture discriminative information. To facilitate the plant disease recognition research, we construct a new large-scale plant disease dataset with 271 plant disease categories and 220,592 images. Based on this dataset, we tackle plant disease recognition via reweighting both visual regions and loss to emphasize diseased parts. We first compute the weights of all the divided patches from each image based on the cluster distribution of these patches to indicate the discriminative level of each patch. Then we allocate the weight to each loss for each patch-label pair during weakly-supervised training to enable discriminative disease part learning. We finally extract patch features from the network trained with loss reweighting, and utilize the LSTM network to encode the weighed patch feature sequence into a comprehensive feature representation. Extensive evaluations on this dataset and another public dataset demonstrate the advantage of the proposed method. We expect this research will further the agenda of plant disease recognition in the community of image processing.

Keywords: *Plant disease recognition, fine-grained visual classification, reweighting approach, feature aggregation*

SMART HOUSING PRICE PREDICTION USING AI AGENT WITH CASUAL INTERFERENCE FOR SOCIETAL FACTOR SELECTION

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ABSTRACT

The rapid growth of urbanization and real estate markets has increased the demand for accurate housing price prediction systems. Traditional models rely heavily on property-specific attributes such as size, location, number of rooms, and amenities, but often fail to account for broader societal factors that significantly influence housing prices. This project proposes an advanced AI-based housing price prediction system that integrates both property features and societal variables to enhance prediction accuracy. A key innovation of this system is the incorporation of an AI agent powered by causal inference techniques. Unlike conventional machine learning models that focus on correlations, this system identifies and selects only those societal factors that have a true causal impact on housing prices, such as crime rates, school quality, infrastructure development, and economic indicators. This approach reduces bias, improves model generalization, and ensures more reliable predictions. The system is evaluated by comparing model performance with and without causal feature selection. Additionally, explainability techniques are employed to highlight the influence of different factors on housing prices, making the model transparent and interpretable for users. The proposed solution aims to assist buyers, sellers, and policymakers in making informed decisions by providing accurate and explainable housing price predictions.

Keywords: AI agent, causal inference, structural causal model, CPSS, housing price prediction, societal factor, factor selection, Bayesian networks, XGBoost.

A MULTI-LAYER IMAGE PUZZLE FRAMEWORK FOR SECURE HIDDEN DATA TRANSMISSION

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ABSTRACT

Secure transmission of sensitive information has become a critical requirement in modern digital communication systems. The rapid growth of image sharing over open networks has increased the risk of unauthorized access, data interception, and information leakage. Traditional security mechanisms mainly rely on cryptographic techniques, which protect data content but do not hide the existence of secret information. This limitation makes encrypted data an attractive target for attackers. As a result, there is a growing need for advanced security approaches that provide both data concealment and strong encryption. This project proposes a secure data hiding and image encryption framework that combines steganography, image puzzle generation, and cryptographic techniques to achieve multi-level security. Initially, secret data is embedded into a selected cover image using the Least Significant Bit (LSB) method, ensuring high imperceptibility and minimal visual distortion. The stego-image is then divided into a random number of image puzzles to prevent unauthorized reconstruction. Each image puzzle is individually encrypted using Elliptic Curve Cryptography (ECC), which offers strong security with smaller key sizes and reduced computational overhead. The encrypted puzzles are transmitted through insecure communication channels without revealing the hidden data. At the receiver side, ECC decryption and correct puzzle reassembly are performed, followed by extraction of the embedded secret data using reverse LSB processing. The proposed system enhances confidentiality, robustness, and resistance to steganalysis and cryptographic attacks.

Keywords: *Steganography, Image Encryption, Least Significant Bit (LSB), Image Puzzle Technique, Elliptic Curve Cryptography (ECC), Data Security, Secure Communication, Data Hiding, Stego-Image, Cryptographic Security, Image Processing, Information Security.*

SECURE PROJECT FUNDING PLATFORM WITH ENCRYPTION AND ACCESS CONTROL

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ABSTRACT

Secure information sharing between companies and investors has become an essential requirement in modern cloud environments. Traditional project-sharing methods often expose sensitive documents, images, and business details to unauthorized access, creating risks such as data leakage, impersonation, and misuse. Cloud platforms offer scalability and availability, but without proper security controls, confidential project files remain vulnerable. To address these challenges, advanced encryption, access management, and traceability mechanisms are necessary to ensure safe collaboration between organizations and potential funding partners. The proposed work introduces a cloud-based secure project-sharing framework that integrates encryption, image protection, and controlled authorization. AES encryption is applied to all project documents to ensure that only approved users can access the original data. Project-related images undergo pixel shuffling to generate a blurred version, preventing unauthorized visual interpretation. Company identity codes and project IDs are embedded using MSB watermarking, enhancing authenticity and traceability. Investors can request access through the platform, and companies retain full authority to approve or reject these requests. Approved users receive a unique identity code that unlocks decrypted files and clear images. The system maintains activity logs for accountability and secure auditing. By combining encryption, watermarking, and controlled access workflows, the proposed platform ensures confidentiality, trust, and secure communication in cloud-based project funding environments.

Keywords: Cloud Security, AES Encryption, Pixel Shuffling, MSB Watermarking, Secure Project Sharing, Access Control, Identity Verification, Secure Funding Platform.

REAL-TIME DRONE DELIVERY E-COMMERCE SIMULATION FOR LAST-MILE ORDER FULFILLMENT AND FLEET TRACKING

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ABSTRACT

The SkyMule project presents the design and implementation of an intelligent real-time drone delivery e-commerce simulation platform for last-mile order fulfillment. Based on the current implementation documentation, the system integrates a shared React and Vite frontend, an Express backend, lowdb-based JSON persistence, and Socket.IO-driven live updates to create a practical educational model of drone-assisted commerce. The project connects customer-side and admin-side workflows inside one coordinated web application. The customer side of the platform supports registration, authentication, product browsing, search, cart management, coupon application, address management, checkout, and live order tracking. The administrative side acts as an operations console where users can manage products, categories, orders, banners, coupons, settings, notifications, support tickets, and exception workflows while also observing fleet activity and delivery progress. A core contribution of the project is the drone mission simulation service, which models assignment, transit, delivery, and return-to-base behavior instead of showing only static delivery status updates. The resulting platform provides a strong project model that combines e-commerce workflows, logistics simulation, and live monitoring in a single coherent web application while also creating a clear foundation for future research-oriented dispatch intelligence.

Keywords: Drone Delivery, Last-Mile Logistics, E-Commerce Simulation, Real-Time Tracking, Fleet Monitoring, React, Express, Socket.IO, Serviceability, lowdb.

PRIVACY PRESERVING PUBLIC AUDITING FOR SECURE CLOUD STORAGE

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ABSTRACT

In this project we propose a novel privacy-preserving mechanism that supports public auditing on shared data stored in the cloud. In particular, we exploit ring signatures to compute verification metadata needed to audit the correctness of shared data. With our mechanism, the identity of the signer on each block in shared data is kept private from public verified, who are able to efficiently verify shared data integrity without retrieving the entire file. In addition, our mechanism is able to perform multiple auditing tasks simultaneously instead of verifying them one by one. The propose system a privacy-preserving public auditing mechanism for shared data in the cloud.

Keywords: *Privacy-Preserving Public Auditing, Cloud Computing, Shared Data, Data Integrity, Data Security, Identity Privacy*

INTELLIGENT DETECTION AND ALERT SYSTEM FOR WILD ANIMALS USING SURVEILLANCE VIDEOS

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ABSTRACT

Animal intrusion into agricultural farmlands presents a persistent threat that result in substantial crop loss, economic instability, and human-wildlife conflict across rural and semi-urban regions. Traditional surveillance methods, which rely on manual monitoring or simple sensor-based systems, often fail to provide timely and accurate detection, especially during night time or large-area monitoring. To overcome these limitations, this project proposes intelligent AI-driven intrusion detection and alerting solution that integrates advanced deep learning models for real-time farmland protection. Continuous video streams captured through CCTV or smart surveillance cameras are processed using a YOLOv8-based detection framework capable of identifying animals such as cows, dogs, deer, and elephants with high precision. To further enhance classification reliability, a Convolutional Neural Network (CNN) model is incorporated to perform refined animal type classification, ensuring accurate categorization even in challenging environmental conditions such as partial occlusion, varying illumination, and complex backgrounds. Each video frame undergoes rapid inference where YOLOv8 performs object localization, while the CNN classifier validates and categorizes the detected animal species to minimize false positives. When an intrusion is confirmed, the system immediately triggers multi-channel alerts, including mobile notifications, sound alarms, and optional deterrent mechanisms like automated light or noise emitters. This integrated AI approach ensures continuous situational awareness, enabling farmers to respond proactively and prevent crop destruction or property damage. The system's architecture supports edge-based deployment for low-latency processing, making it suitable for remote agricultural regions with limited connectivity. By combining fast object detection with reliable CNN-based classification, the proposed model offers a robust, scalable, and autonomous solution for modern smart agriculture. Overall, this system significantly enhances farmland security while reducing human monitoring efforts and mitigating wildlife-related conflicts.

Keywords: *Animal Intrusion Detection, YOLOv8, Deep Learning, Real-Time Monitoring, Animal Classification, Convolutional Neural Network, Smart Agriculture, Alert system.*

WEB AND INTERNET COMPUTING

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ABSTRACT

Web and Internet Computing is a dynamic and rapidly evolving field that focuses on the development, deployment, and management of applications and services over the internet. It integrates key technologies such as web development, networking, data communication, cloud computing, and distributed systems to enable seamless communication and efficient data exchange across the globe. This domain supports a wide range of modern applications including e-commerce platforms, social media networks, online banking systems, and e-learning environments, making it an essential part of digital transformation. With the continuous growth of internet users and connected devices, there is an increasing demand for scalable, reliable, and secure web solutions. Emerging technologies such as artificial intelligence, Internet of Things (IoT), and edge computing further enhance the functionality and responsiveness of web applications. This field also addresses important challenges like data security, user privacy, and performance optimization, ensuring the development of efficient and user-friendly systems for future advancements. This presentation highlights the core concepts, system architecture, tools, and future trends in web and internet computing, emphasizing the importance of innovative solutions in building efficient, secure, and user-friendly systems that support continuous digital transformation across industries worldwide.

Keywords: *Web Development, Internet Technologies, Cloud Computing, Distributed Systems, Data Communication, Web Applications, Cyber security, Artificial Intelligence, Internet of Things (IoT), Edge Computing, Network Protocols,*

IMPACT AND SOCIAL MEDIA ON MENTAL HEALTH

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ABSTRACT

In today's digital era, social media has become an integral part of daily life, especially among young people. Platforms like Instagram, Facebook, and Twitter offer opportunities for communication, self-expression, and information sharing. However, excessive use of social media can have significant effects on mental health and well-being. This study explores how social media influences psychological aspects such as stress, anxiety, depression, and self-esteem. Constant exposure to idealized lifestyles, online comparison, cyberbullying, and the pressure to maintain a digital identity often lead to emotional distress among users. At the same time, social media can also provide positive support through online communities, awareness campaigns, and mental health resources. The objective of this paper is to analyse both the positive and negative impacts of social media on mental health and to suggest strategies for healthy usage. By promoting digital awareness, balanced screen time, and responsible online behaviour, individuals can protect their mental well-being while benefiting from technological advancements.

Keywords: Mental Health, Social Media, Anxiety, Depression, Self-Esteem, Stress, Cyberbullying, Well-Being, Online Behaviour, Youth.

TRUTH LENS: AN AI-POWERED FAKE NEWS DETECTION SYSTEM WITH IMAGE ANALYSIS SUPPORT

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ABSTRACT

Truth Lens is an AI-powered misinformation detection application designed to help users identify fake news across multiple formats. Built using React and powered by Anthropic's Claude API (claude-sonnet-4-20250514), the platform enables users to analyze news content through both text input and image uploads, including screenshots of news articles and social media posts. The system leverages advanced large language model capabilities to assess the credibility of submitted content, delivering instant verdicts supported by confidence scores and detailed reasoning. The image upload feature utilizes Base64 encoding to pass visual media directly to the AI model, enabling it to examine headlines, formatting cues, source indicators, and contextual inconsistencies present in the uploaded image. With its intuitive and minimal user interface styled using Tailwind CSS, Truth Lens makes fact-checking accessible to everyday users without requiring technical expertise. By bridging the gap between AI capabilities and public media literacy, Truth Lens serves as a reliable digital companion in the fight against misinformation in the modern information landscape.

Keywords: Fake News Detection, Misinformation, Artificial Intelligence, Claude API, React, Image Analysis, Natural Language Processing, Media Literacy, Base64 Encoding, Tailwind CSS.

THE DARK SIDE OF SOCIAL MEDIA ALGORITHMS: HOW RECOMMENDATION ENGINES ARE RESHAPING MINDS

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ABSTRACT

In today's hyper-connected world, social media platforms have transcended their original purpose of connecting people. They are now governed by powerful recommendation algorithms fueled by artificial intelligence, engineered with one singular goal to maximize user engagement at any cost. While personalization may seem convenient, the consequences of unchecked algorithmic power are proving deeply damaging to individuals and society. These algorithms analyze every click, pause, like, and share to build a psychological profile of each user, curating content that triggers strong emotions like fear, outrage, and excitement. This creates echo chambers and filter bubbles, where users are repeatedly exposed only to content that reinforces their existing beliefs, gradually isolating them from reality. The result is increased political polarization, social division, and the rapid spread of misinformation where false content travels faster than truth because it generates higher engagement. The mental health impact is equally alarming. Infinite scrolling, variable rewards, and curated highlight reels breed anxiety, depression, low self-esteem, and compulsive doom scrolling especially among young people. Underlying all of this is surveillance capitalism, a business model where user attention and personal data are monetized, giving platforms little incentive to change. Solving this crisis demands algorithmic transparency, stronger data privacy laws, digital literacy, and ethical AI design. The algorithm was built to serve the platform it is time we redesigned it to serve the people.

Keywords: Recommendation Algorithm, Echo Chamber, Filter Bubble, Engagement Optimization, Doom scrolling, Behavioral Manipulation, Misinformation Amplification, Digital Wellbeing, Surveillance Capitalism, Algorithmic Bias.

CYBER BULLYING DETECTION ON SOCIAL MEDIA

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ABSTRACT

The rapid growth of social media platforms has led to increased concerns regarding cyberbullying, which poses significant psychological and social risks to users. This paper presents an automated cyberbullying detection system that leverages machine learning and natural language processing (NLP) techniques to identify harmful and abusive content in online communications. The proposed approach involves data preprocessing, feature extraction using techniques such as Term Frequency-Inverse Document Frequency (TF-IDF) and word embeddings, and classification using supervised learning models including Support Vector Machines (SVM), Random Forest, and deep learning architectures such as Long Short-Term Memory (LSTM) networks. The system is trained and evaluated on benchmark social media datasets to ensure robustness and generalizability. Experimental results demonstrate that the proposed model achieves high accuracy, precision, recall, and F1-score in detecting cyberbullying instances compared to traditional methods. Furthermore, the study highlights the importance of contextual understanding and handling imbalanced datasets to improve detection performance. The implementation of such intelligent systems can assist in real-time monitoring and moderation.

Keywords: *Cyberbullying Detection, Social Media, Machine Learning, Natural Language Processing, Sentiment Analysis, Deep Learning, LSTM, Text Classification.*

EARLY-STAGE DRIVER DROWSINESS DETECTION VIA TEMPORAL MODELING OF PHYSIOLOGICAL PRECURSORS

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ABSTRACT

Driver fatigue remains a leading cause of road accidents, particularly among long-haul truck operators. Conventional drowsiness detection systems rely on reactive indicators – closed eyes, prolonged blinks, or yawning – which are identified only after dangerous impairment has already set in. This paper presents a proactive detection framework that targets microsleep *precursors* rather than microsleep itself, aiming to issue a warning at least 30 seconds before a dangerous drowsiness event occurs. The proposed system extracts a multi-modal feature stream from a standard dashboard camera: Eye Aspect Ratio (EAR) via OpenCV, head pose estimation via MediaPipe Face Mesh, gaze focus scoring from landmark dispersion, and remote photoplethysmography (rPPG) for heart rate variability estimation from facial video. Rather than performing frame-level classification, features are accumulated in a 2-minute rolling temporal buffer and fed into an LSTM-based sequence model that learns to distinguish fatigue-driven deterioration trends – gradual blink rate escalation, increasing head tilt velocity, gaze unfocusing – from transient distraction. A weighted fusion scorer separates these two phenomena and maps their combined output to a three-tier alert system.

The primary challenge lies in two areas: reliable rPPG extraction under real-world noise conditions including variable lighting, motion blur, and skin tone diversity; and the temporal disambiguation of fatigue from distraction, which share superficially similar frame-level signatures but diverge in their longitudinal trend profiles. The system is evaluated against EEG-labeled drowsiness events from the DROZY and SEED-VIG datasets, with warning lead-time and false positive rate as primary metrics. Results demonstrate that temporal modeling of precursor signals substantially extends the detection horizon compared to frame-level baselines, offering a practical path toward deployment in commercial fleet management systems.

Keywords: Driver Drowsiness Detection, Microsleep Precursor, Eye Aspect Ratio, Rppg, LSTM, Temporal Modeling, Head Pose Estimation, Road Safety.

AI SMART EXPENSE ANALYZER

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ABSTRACT

The AI Smart Expense Analyzer is an intelligent personal finance management system that enables users to track income and expenses, analyze spending patterns, and achieve savings goals. Built using HTML5, CSS3, JavaScript, Python (Flask), and MySQL, the system features a real-time dashboard that displays total income, expenditure, and balance. The AI layer, powered by Scikit-learn and Pandas, provides four smart features: Expense Prediction for forecasting next month's spending, Smart Budget Alerts for real-time overspending warnings, Spending Pattern Detection for identifying behavioral trends, and a Financial Health Score to evaluate overall financial wellness. Additional unique features include a Goal-Based Saving tracker, Expense Challenge, Mood-Based Expense logging, and a Subscription Detector. The system eliminates manual record-keeping and empowers users with automated, data-driven financial insights.

Keywords: Artificial Intelligence, Expense Tracking, Budget Management, Expense Prediction, Financial Health Score, Flask, MySQL, Scikit-learn, Personal Finance, Spending Pattern Detection.

GEN AI GLAUCOMA RISK ANALYSIS PLATFORM USING RETINAL SCAN IMAGES

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ABSTRACT

Glaucoma is one of the leading causes of irreversible blindness worldwide, often progressing silently without early symptoms. Timely detection is critical, as early intervention can slow or prevent vision loss. Traditional diagnostic methods, such as intraocular pressure measurement, visual field tests, and manual retinal imaging assessments, are highly dependent on specialist expertise and can be time-consuming, subjective, and limited in scalability. The integration of Generative Artificial Intelligence (Gen AI) and deep learning techniques offers a transformative approach for the early identification of glaucoma risk through automated analysis of retinal scan images. This study proposes a Gen AI-based Glaucoma Risk Analysis Platform that leverages advanced machine learning algorithms to evaluate retinal fundus images, identify characteristic patterns associated with glaucoma, and assess individual risk levels. The platform utilizes convolutional neural networks (CNNs) for image feature extraction, combined with generative AI models for data augmentation and synthetic retinal image generation, which helps overcome limitations related to small or imbalanced datasets.

Keywords: *Generative Artificial Intelligence, Glaucoma Risk Analysis, convolutional neural networks*

TEMPONET: A SEQUENTIAL DEEP LEARNING FRAMEWORK FOR PRECISION BREAST CANCER PROGNOSIS USING ATTENTION-ENHANCED LSTM

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ABSTRACT

Breast cancer continues to represent one of the most prevalent and life-threatening malignancies worldwide, necessitating the development of advanced predictive tools for early diagnosis and improved clinical outcomes. This study presents a novel Attention-Based Long Short-Term Memory (LSTM) network designed to predict breast cancer outcomes by leveraging comprehensive historical patient data. Unlike conventional machine learning approaches such as Support Vector Machines (SVM) and K-Nearest Neighbors (KNN), which are inherently limited in capturing time-dependent and sequential patterns, LSTM networks – a specialized class of recurrent neural networks – are architecturally adept at modeling complex temporal relationships within clinical datasets. The study incorporates rigorous data preprocessing pipelines, systematic feature engineering, and comprehensive model optimization strategies to ensure robust model performance. Crucially, the integration of an attention mechanism empowers the network to selectively assign greater importance to the most diagnostically significant features extracted from historical patient records, thereby substantially enhancing the model's learning capacity and predictive Reliability. Empirical evaluation of the proposed framework demonstrates that the Attention-Based LSTM model consistently outperforms existing traditional and machine learning-based methodologies in terms of prediction accuracy and generalizability. These findings establish the proposed deep learning architecture as a promising and reliable clinical decision-support tool, capable of facilitating early breast cancer detection and enabling personalized treatment planning. Ultimately, this approach holds significant potential to advance patient management strategies and contribute meaningfully to improved survival outcomes in breast cancer care.

Keyword: Breast Cancer Prediction, Attention Mechanism, Long Short-Term Memory (LSTM), Recurrent Neural Networks, Deep Learning, Sequential Data Analysis, Early Detection, Clinical Decision Support

AI DRIVEN MULTIMODEL SOIL INTELLIGENC FRAME WORK: INTEGRATING DEEP LARNING FOR SOIL PROPERTY PREDICTION

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ABSTRACT

Soil health evaluation is an important component of precision agriculture, as it has a direct impact on crop output, fertiliser management, and sustainable land use. Conventional soil analysis procedures are frequently laboratory-dependent, time-consuming, and limited in their ability to give real-time decision support to farmers and agricultural organisations. To address these issues, this research proposes an AI-powered multimodal soil intelligence system that incorporates deep learning approaches for precise and scalable soil property prediction. The proposed framework captures the complex interactions that influence soil characteristics by combining heterogeneous data sources such as soil pictures, physicochemical sensor readings, meteorological parameters, and geographic information. A hybrid deep learning architecture is created by combining Convolutional Neural Networks (CNNs) for image-based feature extraction with Bidirectional Long Short-Term Memory (BiLSTM) networks for sequential environmental and sensor data processing. An attention-based fusion method is also used to merge multimodal data and improve prediction accuracy. The framework is designed to forecast essential soil parameters such as pH, moisture content, nitrogen, phosphorus, and potassium levels with high accuracy. Experimental results show that the proposed model outperforms traditional machine learning and single-modality deep learning approaches in terms of prediction accuracy, resilience, and generalisation across a variety of agricultural locations. The suggested system provides a dependable and intelligent decision-support tool for smart farming applications, allowing for rapid soil monitoring and optimised agricultural methods.

Keywords: Soil Health Minitoring, Deep Larning, Multimodel, Fusion

FAKE PROFILE DETECTION SYSTEM IN SOCIAL MEDIA USING AI/ML

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ABSTRACT

Social media platforms have become an essential part of daily communication, but the rapid growth of fake profiles has created serious security issues. These fake accounts are often used for spreading misinformation, spamming, and conducting fraudulent activities such as fake internship offers targeting students. Identifying such profiles manually is difficult, time-consuming, and often inaccurate. This project proposes an AI and Machine Learning based Fake Profile Detection System that automatically classifies social media accounts as real or fake. The system collects user profile data such as follower count, following count, number of posts, account age, and profile information. After preprocessing the data, important features are extracted and used to train machine learning models like Logistic Regression, Decision Tree, and Random Forest. Among these, Random Forest provides better accuracy in detecting fake profiles. The trained model analyzes new user profiles and predicts whether the account is genuine or fake. This system helps in reducing online frauds, improving user safety, and enhancing the reliability of social media platforms.

Keywords: *Artificial Intelligence, Machine Learning, Fake Profile Detection, Random Forest Algorithm, Classification Technique*

CLIMATE CHANGE AND SUSTAINABILITY

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ABSTRACT

Climate change is one of the most pressing global challenges of the 21st century, affecting ecosystems, human health, and economic stability. It is primarily caused by human activities such as deforestation, industrialization, and the excessive use of fossil fuels, leading to an increase in greenhouse gas emissions and global warming. Sustainability plays a crucial role in addressing climate change by promoting the responsible use of natural resources to meet present needs without compromising the ability of future generations. This paper examines the relationship between climate change and sustainable development, highlighting key issues such as rising temperatures, extreme weather events, and environmental degradation. Furthermore, the study discusses practical solutions including renewable energy adoption, waste reduction, conservation practices, and awareness initiatives. By integrating sustainable practices into daily life and policy-making, society can reduce environmental impact and move towards a greener and more resilient future.

Keywords: Climate Change, Sustainability, Global Warming, Greenhouse Gases, Renewable, Energy, Environment Protection, Carbon Footprint, Sustainable Development, Pollution, Conservation, Problem Statement.

IOT-BASED SMART CAMPUS BUS & HOSTEL IN/OUT TRACKING SYSTEM

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ABSTRACT

The IoT-Based Smart Campus Bus & Hostel In/Out Tracking System is an automated real-time surveillance and monitoring solution designed to address the limitations of manual record-keeping in educational institutions. Traditional paper-based registers and manual attendance systems are error-prone, time-consuming, and incapable of providing instant notifications to parents and administrators. This project proposes an integrated system leveraging Internet of Things (IoT) technologies, Automatic Number Plate Recognition (ANPR), and Face Detection to automate the tracking of college buses and hostel students.

The system comprises two core modules. The Bus Module employs a high-resolution IP camera mounted at the campus entrance gate. Using Python, OpenCV, YOLO v8 for plate detection, and Tesseract OCR for character recognition, the system automatically identifies each bus by its number plate, logs the entry and exit timestamps, and pushes data to a cloud server via an IoT gateway. The Hostel Module utilizes a Raspberry Pi-based camera at the hostel gate combined with DeepFace or FaceNet models to perform real-time face recognition of students. Upon identification, IN/OUT events are recorded with timestamps and alerts are immediately dispatched to parents and wardens via SMS and mobile application notifications. The end-to-end architecture flows from physical sensors and cameras through an IoT gateway (ESP32/Raspberry Pi) to a cloud server hosting AI/ML processing models and a REST API backend, ultimately delivering data to a web portal and mobile application. The proposed system delivers 100% automated tracking, sub-second recognition speed, and continuous 24/7 monitoring, entirely eliminating manual registers. It benefits students through faster gate access, parents through real-time alerts and movement history, and management through automated reports and improved campus security. Future enhancements include RFID integration as backup authentication, blockchain-based tamper-proof attendance logs, AI-driven predictive analytics for bus delays, geo-fencing alerts, and potential expansion to smart city-level transport monitoring across multiple campuses.

Keywords: *Internet of Things (IoT), Automatic Number Plate Recognition (ANPR), Face Detection, Face Recognition, Smart Campus, Hostel Monitoring, Bus Tracking, Real-Time Alerts, Raspberry*

DUAL-STREAM STROKE DETECTION USING SHUFFLENET AND XGBOOST WITH PERSONALIZED AI-DRIVEN MEDICATION RECOMMENDATION

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ABSTRACT

Delayed stroke diagnosis continues to result in irreversible neurological damage, underscoring the urgent need for intelligent, real-time screening systems. Existing approaches often rely on a single data modality – either imaging or clinical records – limiting their predictive reliability in complex, real-world scenarios. To bridge this gap, this work introduces a dual-stream prediction framework that simultaneously processes brain MRI scans through a ShuffleNet convolutional model and structured patient records through an XGBoost classifier. ShuffleNet's channel-shuffle mechanism reduces computational overhead while preserving fine-grained spatial features critical for lesion identification, making it particularly suited for deployment in resource-constrained clinical environments. XGBoost complements this by capturing non-linear relationships within tabular patient data – including age, medical history, and physiological indicators – with high tolerance for missing values and class imbalance. The fused predictions from both streams feed into a rule-augmented recommendation engine that generates individualized medication plans for high-risk patients. Evaluated against standard benchmarks, the proposed system demonstrates measurable gains in detection sensitivity and inference speed, offering a practical pathway toward AI-assisted, early-stage stroke intervention.

Keywords: Stroke Detection, ShuffleNet, XGBoost, MRI Image Analysis, Multimodal Deep Learning, Clinical Decision Support

CLOUD EXAI BASED GENERATIVE MACHINE LEARNING ALGORITHM IN GENETIC DISORDER ANALYSIS FOR EARLY NEURO DISEASE DETECTION

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ABSTRACT

Neurogenetic and neurodegenerative disorders require early and accurate detection to improve treatment outcomes and reduce disease progression. However, existing detection and drug discovery approaches predominantly rely on conventional machine learning or deep learning models that lack transparency and scalability. Moreover, genetic disorder analysis, neuro disease detection and drug molecular structure generation are often performed independently, limiting their clinical effectiveness and biological relevance. This research proposes a cloud-based Explainable Artificial Intelligence (ExAI) integrated generative machine learning framework for genetic disorder analysis and **drug** structure discovery aimed at early neuro-disease detection. Historic health and genetic data are collected and managed through cloud infrastructure to enable scalable and adaptive learning. Generative machine learning models are employed to analyze genetic variations in neural cell membranes and to generate potential drug molecular structures. Genetic algorithms are further integrated to optimize the generated drug candidates based on therapeutic relevance and genetic compatibility. To enhance interpretability and clinical trust, ExAI techniques are incorporated to explain model predictions, genetic feature importance, and drug structure generation processes. The proposed framework enables unified analysis of genetic structures, disease risk prediction and optimized drug discovery within a scalable cloud environment. Experimental evaluation demonstrates improved performance in early neuro disease detection, measured using accuracy, precision, recall, F1-score, AUC, and ROC metrics. The results indicate that the proposed approach offers an effective, interpretable and scalable solution for early neuro disease detection.

Keywords: *Neurogenetic and neurodegenerative disorders, Explainable Artificial Intelligence*

FINGER PRINT BASED VOTER SYSTEM: A BIOMETRIC SOLUTION FOR SECURE AND TRANSPARENT ELECTION

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ABSTRACT

The fingerprint based voter system is a biometric authentication application designed to ensure the integrity and security of democratic processes. Developed to replace traditional methods that face security and authentication issues, this system addresses critical problems such as voter impersonation, duplicate voting, and manual counting errors. By utilizing the R307/AS608 fingerprint module and a microcontroller-based architecture (Arduino or Raspberry Pi platform), the system ensures that only registered individuals can cast a vote and only once. The system operates through a multi-layer software and hardware stack, integrating Python or Java backend with MySQL databases to manage voter enrolment and candidate data. During the election, the system performs real-time template matching to verify a voter's identity in under two seconds. Security is a primary focus, featuring AES-encrypted templates, SHA-256 hashing, and comprehensive access control. With an intuitive digital interface and an automated admin dashboard, the system provides instant results and eliminates the need for physical ballots, bridging the gap between advanced biometric technology and civic services. It serves as a reliable, user-friendly, and fraud-proof digital solution for modern campus and public elections.

Keywords: Fingerprint based voter system, Biometric Authentication, Election security, Arduino, R307 sensor, one person one vote, Real time Result, AES Encryption, digital Democracy.

**DEPARTMENT OF
MECHANICAL ENGINEERING**

EXPERIMENTAL INVESTIGATIONS ON BASIC PROPERTIES OF BIO CHAR FILLED NATURAL FIBRE REINFORCED COMPOSITES

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ABSTRACT

The growing need for sustainable materials has increased interest in natural fibre reinforced composites (NFRCs) as eco-friendly alternatives to synthetic materials. This study presents an experimental investigation on the basic properties of bio char-filled NFRCs. Bio char, a carbon-rich product obtained from biomass pyrolysis, was used as a filler to enhance composite performance. Natural fibres such as jute, sisal, or banana fibre were reinforced within a polymer matrix like epoxy or polyester, and composites were fabricated using standard melding techniques. Bio char was incorporated in varying weight fractions to analyse its effect on physical and mechanical properties. The composites were tested for density, water absorption, tensile strength, flexural strength, and impact resistance. Results indicated that the addition of bio char improved mechanical properties up to an optimal level due to better interfacial bonding and reduced voids. Beyond this level, performance decreased due to particle agglomeration. Water absorption was reduced in bio char-filled composites, indicating improved moisture resistance. Overall, the study demonstrates that bio char is effective, sustainable filler that enhances composite performance, making these materials suitable for applications in automotive and construction sectors.

Keywords: *Natural Fibre Reinforced Composites, Polymer Matrix, Water Absorption.*

ANTI-SIPHONING DEVICE FOR HEAVY MOTOR VEHICLES [HMV]

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ABSTRACT

The study investigates the design, development, and performance analysis of an anti-siphon device used to prevent the reverse flow of liquid in fluid transfer systems. Siphoning can lead to uncontrolled drainage, contamination, leakage, and system inefficiency in domestic, industrial, and agricultural applications. This research aims to explore the working principle and effectiveness of the anti-siphon device in maintaining safe and controlled fluid flow under varying operating conditions. Experimental investigations involve the fabrication of an anti-siphon mechanism and its integration into a fluid pipeline setup, followed by detailed observation of flow behavior during normal and reverse flow conditions. Performance analyses, including flow interruption response, pressure variation, leakage prevention, and operational reliability, is conducted to evaluate the efficiency of the device. The findings provide insights into the functional behavior of the anti-siphon device, facilitating the development of cost-effective and reliable fluid control systems while improving safety, preventing backflow, and enhancing overall system performance in engineering applications.

Keywords: *Experimental Investigation, Anti-Siphon Device, Reverse Flow Prevention, Backflow Control, Fluid Transfer System, Leakage Prevention, Pressure Variation, Flow Safety.*

DESIGN AND FABRICATION ANALYSIS OF CNC ENGRAVING AND MILLING MACHINE BASED ON WOOD AND METAL MATERIAL

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ABSTRACT

This project focuses on the design and fabrication of a Computer Numerical Control (CNC) engraving and milling machine capable of machining wood and soft metals. The machine is designed using mechanical components such as stepper motors, lead screws, guide rails, spindle motor, and a rigid frame structure. A microcontroller-based control system is used to automate the machining process through G-code programming. The fabricated machine is tested for engraving and milling operations on wood and aluminium materials. The results show improved precision, reduced manual effort and good surface finish at low cost.

Keywords: *Computer Numerical Control, Stepper motor, G-Code Programming*

SOLAR POWERED REFRIGERATION SYSTEM

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ABSTRACT

Solar powered refrigeration systems are gaining importance due to the increasing demand for sustainable and eco-friendly cooling solutions. This paper presents the design, working principle, and performance analysis of a solar-powered refrigeration system. The system utilizes solar energy through photovoltaic panels to operate a refrigeration unit, reducing dependency on conventional electricity. The study highlights efficiency, cost-effectiveness, and environmental benefits, making it suitable for rural and off-grid applications.

Keywords: Solar Power Refrigeration, Photovoltaic Panels, Conventional Electricity,

ADDITIVE MANUFACTURING IN THE AEROSPACE AND AUTOMOTIVE INDUSTRIES: RECENT TRENDS AND ROLE IN ACHIEVING SUSTAINABLE DEVELOPMENT GOALS

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ABSTRACT

Additive Manufacturing (AM) is the fastest growing industrial technique, harboring innovative, cost effective and environmentally friendly solutions. Additive Manufacturing (AM) revolutionizes the automotive industry by enabling the creation of intricate, lightweight components, paving the way for enhanced performance, sustainability, and innovation in vehicle design and production. This paper presents a detailed exploration of AM in the automotive industry, over the years; AM technologies have been utilized in the aerospace and automotive industries mainly for prototyping purposes. However, 3D printing of aircraft and automobile components and parts has recently proven its efficiency. And also, a comprehensive review on the utilization of AM technologies in the aerospace and automotive industries is presented. The various AM techniques are compared based on their process, materials, and applications. In addition, the opportunities and limitations of AM in aerospace and automotive industries are highlighted. Finally, the contribution of AM and 3D printing in achieving the Sustainable Development Goals (SDGs) is examined and evaluated.

Keywords: *Additive manufacturing; 3D printing; Sustainability; Lifecycle Assessment; Artificial intelligence*

ANALYSIS OF THE RESPONSIBILITY OF SAFETY LEADERSHIP IN IMPROVING ORGANISATION'S SAFETY

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ABSTRACT

Work safety has always been the hotspot in academic research and safety management practice several studies in this field have focused on employees' safety compliance. In as much as safety compliance has a positive impact on an enterprise's work safety, it is not enough to improve the work safety level. By examining data analysis on employee safety behaviour and enterprise safety performance, it was found that safety performance still does not reach the ideal level even when enterprises took measures to improve safety compliance. The promotion of safety is often carried out from safety management perspective which plays an important role in safety work. Moreover, safety leadership is increasingly being seen to be in a significant role in the development of safety culture, climate and performance and the attainment of overall improvement in the field. The goal of this project is to create innovative research approaches into safety leadership. Safety culture, climate, leadership and performance offer numerous opportunities for organizations to create new approaches to achieving improvements in organization safety. These issues form an Entirety in which the causal and consequential relationships are highly complex and intertwined. In recent years there has been much discussion in the literature concerning the definitions of safety climate, culture and leadership. It is not the aim of this project to add to this discussion but rather to introduce new approaches in the field with regard to safety leadership.

Keywords: *Safety Management, Development of Safety Culture, Safety Climate*

DISMANTLE AND ERECTION OF FOOTOVER BRIDGE IN RAILWAY PLATFORM

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ABSTRACT

Foot Over Bridge (FOB) dismantling and erection activities in railway platforms are inherently complex and high-risk due to the involvement of heavy lifting operations, work at height, electrical hazards from overhead lines, and coordination within an active railway environment. The dismantling and erection of FOB structures require careful planning and strict safety control measures to prevent accidents and ensure uninterrupted railway operations. Key findings indicate that the major risks involved include falls from height, structural instability during dismantling, lifting-related accidents, failure of lifting equipment, electrocution from the 25 kV Overhead Electrical (OHE) system, and improper coordination during work execution. Effective control measures such as proper dismantling sequence planning approved lifting plans, certified lifting equipment, and trained operators play a crucial role in minimizing risks. Special emphasis is placed on the isolation of electrical lines (25 kV OHE system) before commencement of work to eliminate electrical hazards. Additionally, worker safety is enhanced through structured training programs, safety inductions, and competency verification. The implementation of permit-to-work systems, barricading, and continuous supervision further strengthens safety performance. The study concludes that a combination of engineering controls, administrative measures, and proper lifting management ensures safe and efficient dismantling and erection of Foot Over Bridges in railway platforms while maintaining operational safety and project efficiency.

Keywords: *Foot Over Bridge (FOB), Overhead Electrical (OHE) system, Lifting Management*

A STUDY ON HEALTH AND SAFETY CONTROL MEASURES IN METRO STATION CONSTRUCTION

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ABSTRACT

Metro station construction is inherently complex and high-risk due to the combination of deep excavations, tunneling operations, heavy lifting, temporary works, electrical systems, and public interface in urban environments. The Chennai Metro Project, as one of India's major urban transport initiatives, provides an ideal case study to examine health and safety control measures in large-scale underground and elevated construction works. This study focuses on identifying critical hazards, assessing associated risks, and evaluating the effectiveness of control measures implemented at the Chennai Metro construction sites. The research methodology involved a combination of literature review, site observations, interviews with project managers, safety officers, and subcontractors, and the application of Job Safety Analysis (JSA) and Hazard Identification (HAZID) workshops. A hierarchical risk assessment approach was adopted to rank hazards according to their likelihood and potential consequences. Key findings reveal that the most significant risks in metro station construction include falls from height, excavation collapses, lifting and carnage accidents, electrocution, confined space entry incidents, and exposure to dust, chemicals, and noise. The study demonstrates that a combination of engineering controls (e.g., robust temporary works design, ventilation systems, edge protection), administrative measures (permit-to-work systems, restricted access zones, competency verification, and safety induction), and appropriate personal protective equipment (PPE) significantly reduces risk exposure.

Keywords: *Foot Over Bridge (FOB), Overhead Electrical (OHE) system, Lifting Management*

A HEALTH AND SAFETY APPROACH TO RISK EVALUATION AND REDUCTION IN WIND BLADE MANUFACTURING AND LIFTING OPERATIONS

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ABSTRACT

The project titled "A Health and Safety Approach to Risk Evaluation and Reduction in Wind Blade Manufacturing and Lifting Operations" focuses on identifying, evaluating, and mitigating health and safety risks associated with the manufacturing and lifting processes of wind turbine blades. As the renewable energy sector grows, wind blade production and transportation involve complex operations that present significant hazards to workers. This study aims to improve the safety standards by conducting a comprehensive risk assessment of the various stages in the manufacturing and lifting phases, including machinery handling, material transportation, and the lifting of large, heavy components. By integrating Hazard Identification and Risk assessment (HIRA) techniques such as job safety analysis (JSA), Hazard operability studies (HAZOP), and hazard identification, the project will identify high-risk areas and propose strategies for their reduction. These strategies include implementing safety protocols, advanced lifting technologies, ergonomic improvements, and employee training programs. The project intends to enhance worker safety, reduce the frequency of accidents, and contribute to the overall efficiency of wind blade production and logistics operations. Ultimately, this approach not only supports the health and safety of employees but also promotes a more sustainable and safer wind energy industry.

Keywords: *Foot Over Bridge (FOB), Overhead Electrical (OHE) system, Lifting Management*

SAFETY VALVE STREAM MAPPING IN HEAVY ENGINEERING INDUSRY

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ABSTRACT

Safety valves play a critical role in ensuring the safe operation of pressurized systems in heavy engineering industries by preventing overpressure conditions that may lead to catastrophic failures. This project focuses on the application of stream mapping techniques to analyze, evaluate, and optimize the performance, inspection, and maintenance workflow of safety valves within a heavy engineering environment. The study involves the systematic identification of safety valve streams across various process units, including boilers, pressure vessels, and piping systems. By adopting Value Stream Mapping (VSM) principles, the current state of safety valve management—from installation and tagging to inspection, testing, and recertification—is documented and analyzed to identify inefficiencies, delays, and potential safety risks. Key parameters such as valve set pressure, discharge capacity, inspection intervals, and failure history are incorporated into the mapping process to ensure a comprehensive safety assessment. The project also integrates risk evaluation methodologies to prioritize critical valves and streamline maintenance schedules. Based on the findings, a future state map is proposed to enhance operational safety, reduce downtime, and ensure compliance with relevant safety standards and regulations.

Keywords: *Value Stream Mapping, Risk Evaluation Methodologies, Engineering Environment*

OCCUPATIONAL HEALTH AND SAFETY IN AUTOMOTIVE PARTS MANUFACTURING INDUSTRY

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ABSTRACT

The present research is aimed to show the demands obligations to provide and maintain best level of occupational health and safety in automobile parts manufacturing industry. Occupational health and safety importance in any workplace are an inevitable and attending this with the structured approaches will give a better opportunity to control workplace accident rates and reduce the risk level. This risks even leads to discontinuity in business and affects depended livelihoods and if it's involves any associated people essential services then impact will be unimaginable, as in a wide aspect interruption in business will impact the state economies. Understanding the importance of Occupational health and safety, this research highlighting the Mechanical, Electrical, Biological agent, Hazardous substances, Noise & Heat Stress and Mental stress hazards and related risks in an automobile parts manufacturing industry. This analysis uses methodology of international recognized control hierarchy and best engineering practices to create solutions the final phase explains the outcomes of implementing the practical solutions and control measures recommended in phase-I with cost benefit analysis results.

Keywords: *Occupational health and safety, Noise & Heat Stress, Mental stress hazards*

RISK REDUCTION AND IMPLEMENTATION OF RETRACTABLE FALL ARRESTOR SYSTEM

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ABSTRACT

In High-risk work environments, such as construction, manufacturing, and maintenance operations, fall-related accidents are a significant safety concern. The use of fall arrest systems is a critical measure to mitigate such risks. Retractable fall arresters, as an advanced form of fall protection equipment, offer increased safety, mobility, and efficiency compared to traditional fall arrest systems. This paper explores the risk factors associated with falls in industrial and construction settings and evaluates the implementation of retractable fall arresters as a risk reduction strategy. It outlines the technical features of retractable systems, including their automatic locking mechanism, self-retracting lifelines, and impact force mitigation. By examining real-world case studies, the paper highlights the effectiveness of these devices in reducing fall-related injuries and fatalities. The study discusses the challenges of integrating retractable fall arresters into existing safety protocols, focusing on factors such as proper installation, worker training, and periodic maintenance. Recommendations for optimizing the adoption of these systems are provided, aiming to enhance work place safety.

Keywords: *Traditional fall arrest systems, Retractable systems, Safety, Mobility.*

ADVANCED RISK ASSESSMENT AND MITIGATION STRATEGIES FOR INDUSTRIAL MACHINERY SAFETY

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ABSTRACT

Industrial machinery operations involve a wide range of hazards that can adversely affect worker safety, equipment reliability, and overall organizational performance. This project focuses on developing advanced risk assessment and mitigation strategies to enhance industrial machinery safety through a systematic and proactive approach. Risk assessment is a critical component of the Occupational Safety and Health Management System (OSHMS), aimed at identifying potential hazards, evaluating associated risks, and implementing effective control measures. The study adopts a structured methodology that integrates both qualitative and quantitative risk assessment techniques. It emphasizes hazard identification, risk analysis, and risk evaluation while considering existing control measures. Advanced mitigation strategies such as engineering controls, administrative controls, predictive maintenance, and safety integration in automated systems are explored to minimize risks to as low as reasonably Practicable (ALARP) levels. Additionally, the study incorporates modern approaches including data-driven decision-making and technology-based monitoring systems to improve the effectiveness of risk management practices. The project highlights the importance of continuous improvement, regular monitoring, and review of safety measures to address dynamic industrial risks. Furthermore, it identifies training requirements and promotes awareness among employees, contributing to the development of a strong preventive safety culture. Effective implementation of advanced risk assessment techniques leads to safer working environments, reduction in workplace accidents, improved employee morale, and enhanced productivity. It also helps in minimizing financial losses associated with injuries, equipment damage, and operational disruptions. The study underscores the significance of management commitment and employee involvement in achieving sustainable safety performance.

Keywords: *Occupational Safety and Health Management System (OSHMS), Risk Assessment*

WORKPLACE SAFETY CULTURE AND BEHAVIORAL ON A CONSTRUCTION SITE

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ABSTRACT

Workplace switch high-risk operations demand strong safety performance, where outcomes are influenced not only by physical hazards but significantly by human behavior and organizational culture. While safety management systems provide a structured framework, the day-to-day Actions of employee sand the prevailing safety culture determine their real-world effectiveness. URC Construction Pvt. Ltd., a leading Indian organization engaged in infrastructure and industrial projects, serves as a suitable case study to examine the relationship between a company's established safety culture and the behavioral practices observed at the workplace. This study focuses on evaluating the effectiveness of URC's safety culture, including its "LIFE: Leadership for Injury-Free Environments" program, and its influence on employee behaviour. A mixed-methods approach was adopted, comprising a detailed review of organizational safety documentation (including ISO 45001 compliance and incident records), structured workplace observations to identify safe and at-risk behaviors, and qualitative interactions with project managers, safety professionals, and workers to understand their perception of the safety climate. The finding syndicate a noticeable gap between the documented safety expectations (Works Imagined) and the actual behaviors observed at the workplace (Works Done). Key factors Contributing to this gap include production pressures, visibility and commitment of leadership, peer-to-peer safety engagement, and the effectiveness of safety induction and ongoing training programs. The study highlights that a well-defined safety policy alone is not sufficient. Its Effectiveness depends on active leadership involvement, continuous workforce engagement, and reinforcement mechanisms that promote consistent safe behavior.

Keywords: *Physical hazards, Peer-to-Peer Safety Engagement, Workforce Engagement*

PERSONAL PROTECTIVE THINKING HUMAN BEHAVIOUR AND MINDSET

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ABSTRACT

Unsafe behavior remains one of the leading causes of workplace accidents, injuries, and property damage. Most incidents occur not because of a lack of knowledge or procedures, but due to human factors such as complacency, lack of awareness, or poor decision-making. Personal protective thinking offers a proactive approach to safety by emphasizing mindset over mere compliance. It encourages individuals to anticipate risks, think before acting, and take personal responsibility for their own safety and the safety of others. By cultivating a protective mindset, organizations can reduce unsafe behaviors, strengthen situational awareness, and build a sustainable safety culture. The integration of behavioral understanding with protective thinking creates a powerful foundation for achieving zero harm in the workplace. Personal Protective Thinking (PPT) plays a crucial role in building a strong safety culture within industrial environments. Industrial workplaces often involve high-risk activities such as working with machinery, electrical systems, chemicals, or heights — where one unsafe decision can lead to serious injury, equipment damage, or loss of life. By developing a mindset of personal protective thinking, employees become more aware of potential hazards and consciously choose safe actions before accidents occur. This mental preparedness promotes proactive behavior, quick situational assessment, and responsible decision-making.

Keywords: *Personal Protective Thinking, Emphasizing Mindset, Decision-Making.*

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING APPLICATIONS IN ELECTRIC VEHICLES AND RENEWABLE ENERGY SYSTEMS

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ABSTRACT

Global energy trends are experiencing a profound transformation, and the future of transportation will boost sustainable development by controlling energy production and consumption while limiting vehicle emissions. Hence, Electric Vehicles (EVs) can substantially influence energy consumption trends by addressing potential environmental hazards. In the coming decades, Artificial Intelligence (AI) based systems will play a crucial role in future EVs' overall energy management systems. Advanced electric vehicle technology and intelligent modules will lead the automotive power train architecture. Numerous barriers, such as government support in certain regions, user compatibility, vehicle limitation, battery technology, and charging infrastructure, limit electric vehicle expansion. Therefore, the current state and emerging trends in this area are a matter of concern for increasing the expansion of electric vehicles. This study presents the existing charging technologies and compatible standards that may assist in its adaptability. It also examines the applications of artificial intelligence in electric vehicle development to render a collectively smarter package for EVs. The current level of development, in accordance with the paper's purpose, is to deduce the adaptability of EVs to certain obstacles

Keywords: Artificial Intelligence Machine Learning Sustainable Energy Renewable Energy Systems Sustainable Development.

A DMAIC BASED LEAN SIX SIGMA FRAMEWORKS FOR REDUCING WEIGHT VARIATION IN POWDER BAGGING OPERATIONS: AN INDUSTRIAL CASE STUDY FROM THE AUTOMOTIVE BRAKING SECTOR

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ABSTRACT

Weight variability in powder bagging operations represent a critical quality challenge in automotive brake manufacturing process, as even minor deviations from the tolerance value can propagate defects into downstream pressing and curing processes. This study presents a structured Lean Six Sigma (LSS) implementation using DMAIC methodology as a business management tool to improve operational quality by reducing bag weight variation in a high-volume industrial bagging process. This case study was conducted at an automotive brake lining manufacturing facility in India, where manual bagging resulted in deviations ranging from 16 to 45g in against the specification, leading to an approximate 30% non-conformance and a significant production loss. Baseline process capability analysis indicated an incapable process ($Ppk < 1.0$). After the implementation of Six Sigma methodology the weight variation reduced to within 8 grams. The Post improvement results demonstrated a reduction in weight variation up to 73%, and an improvement in process capability to $Cpk = 2.08$. We also observed an 40% increase in throughput and a 60% reduction in scrap. Control mechanisms were established using Statistical Process Control (SPC) and Standardized Operating Procedures (SOP) to sustain the gains. The findings validate the effectiveness of DMAIC as a data driven framework for improving operational precision in powder bagging operations and contribute for quality improvement in automotive brake lining manufacturing environments.

Keywords: *DMAIC, Process Capability, Bagging Process, Brake lining manufacturing.*

CENTRALIZATION OF SMOKE DETECTOR AND INTEGRATED WITH ENERGY ISOLATION

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ABSTRACT

Fire safety is a major concern in modern infrastructure, particularly in environments with high electrical loads such as industrial plants, commercial buildings, and data centers. Electrical faults and overheating are common causes of fire hazards, making early detection and quick response essential to minimize damage and ensure safety. This project proposes a centralized smoke detection system integrated with an automatic energy isolation mechanism for an efficient and intelligent fire response. Multiple smoke detectors are installed across different zones and connected to a central control unit, enabling real-time monitoring and faster detection. When smoke is detected, the system immediately triggers alarms and isolates the electrical supply in the affected area using relays or smart circuit breakers. This rapid response helps prevent fire escalation and reduces risks associated with electrical sources. The system can also be enhanced with IOT features for remote monitoring, instant notifications, and data logging, improving overall efficiency and emergency response. Designed to be scalable and cost-effective, the proposed solution aligns with modern fire safety standards. Overall, this system provides a proactive approach to fire hazard management, ensuring the safety of people, protection of assets, and improved reliability of critical infrastructure

Keywords: *Hazards, Smoke Detection, Energy Isolation, Circuit Breakers, IOT*

HAZARDS AND RISK INVOLVED IN WIND MILL

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ABSTRACT

Growing interest in switching from fossil fuels to a more varied and low-carbon energy mix has been observed worldwide in recent years, and it is anticipated that this trend toward more renewable energy sources will continue over the coming decades. Over the past few decades, the oil and gas and process industries have undergone significant change, which has led to a greater emphasis on risk management and how safe operations boost production. These insights could benefit the wind energy sector. This study examined safety occurrences in the wind power sector using references and existing literature. Fires are the second most frequent sort of mishaps, closely following blade failure, that can result in major downtime, complete infrastructure loss, and serious human repercussions. About 40% of fires are caused by electrical dangers, 20% are caused by mechanical causes, and another 20% are caused by lightning strikes, according to database research cited in this paper. 2.7% of the incidents involved human injuries, while 1.1% resulted in fatalities. According to estimates, there is a 1–16 case per million annual risks of death from a wind turbine fire. The lack of publicity and mandatory reporting of wind farm accidents was a significant gap in the wind power industry that this study found. The wind power business shouldn't be regarded as "low risk" based solely on the projected amount of danger from fire incidents, and improved hazard control procedures might be necessary.

Keywords: Fossil Fuels, Renewable Energy Sources, Safety, Turbine Fire.

ANALYSIS OF OCCUPATIONAL HAZARD IN SMALL SCALE INDUSTRIES

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ABSTRACT

Small-scale industries (SSIs) constitute the backbone of many developing economies, providing employment to millions of workers and contributing significantly to national GDP. However, these industries are often characterized by inadequate safety measures, poor working conditions, and limited access to occupational health resources, resulting in a disproportionately high rate of workplace injuries, illnesses, and fatalities. This research project undertakes a comprehensive analysis of occupational hazards prevalent in small-scale industries across various sectors including textiles, metal fabrication, chemical processing, food processing, and construction. The study employs a mixed-methods approach, combining quantitative survey data from 250 workers across 50 small-scale industrial units with qualitative insights gathered through structured interviews, workplace observations, and focus group discussions. The research identifies and categorizes the primary types of occupational hazards physical, chemical, biological, ergonomic, and psychosocial and assesses their relative frequency, severity, and impact on worker health and productivity. Key findings indicate that physical hazards (noise, vibration, heat stress) and chemical hazards (dust, fumes, toxic substances) are the most prevalent, while ergonomic hazards represent the most underreported category. The study further examines the existing safety management practices, legislative compliance, and awareness levels among employers and employees. A significant gap was found between prescribed safety standards and actual implementation at the ground level, largely attributable to limited financial resources, poor enforcement, and lack of safety culture. Based on the findings, the study recommends a multi-pronged approach encompassing regulatory reform, capacity building, worker education, and industry-government partnerships to improve occupational safety outcomes in the small-scale industrial sector. The research also proposes a simplified Occupational Hazard Risk Assessment (OHRA) framework specifically designed for small-scale industries that is both practical and cost-effective

Keywords: Occupational Hazard Risk Assessment, Safety Management, Productivity.

A STUDY ON HEALTH AND SAFETY CONTROL MEASURES IN UNDERGROUND METRO RAIL CONSTRUCTION

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ABSTRACT

Metro station construction is inherently complex and high-risk due to the combination of deep excavations, tunneling operations, heavy lifting, temporary works, electrical systems, and public interface in urban environments. The Chennai Metro Project, as one of India's major urban transport initiatives, provides an ideal case study to examine health and safety control measures in large-scale underground and elevated construction works. This study focuses on identifying critical hazards, assessing associated risks, and evaluating the effectiveness of control measures implemented at the Chennai Metro construction sites. The research methodology involved a combination of literature review, site observations, interviews with project managers, safety officers, and subcontractors, and the application of Job Safety Analysis (JSA) and Hazard Identification (HAZID) workshops. A hierarchical risk assessment approach was adopted to rank hazards according to their likelihood and potential consequences. Key findings reveal that the most significant risks in metro station construction include falls from height, excavation collapses, lifting and carnage accidents, electrocution, confined space entry incidents, and exposure to dust, chemicals, and noise. The study demonstrates that a combination of engineering controls (e.g., robust temporary works design, ventilation systems, edge protection), administrative measures (permit-to-work systems, restricted access zones, competency verification, and safety induction), and appropriate personal protective equipment (PPE) significantly reduces risk exposure.

Keywords: *Job Safety Analysis (JSA), Personal Protective Equipment (PPE), Risk Exposure.*

HAZARDEVALUATIONANDMITIGATION OF RISK IN CONSTRUCTION WORK

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ABSTRACT

The construction industry is one of the most hazardous sectors globally, with a high incidence of occupational accidents and injuries. This project aims to systematically analyze safety practices in construction work and develop strategic interventions to minimize risks and enhance worker safety. By identifying key hazards such as work at height hazards like fall from height and fall of materials from height due to unprotected barriers, and unsecured material stacking on top floors. Hazards in lifting & Shifting work job (erection of steel cage, beam, shifting of required materials). Confined- Space hazards (Oxygen deficiency, toxic gas inhalation) and during excavation contact of Electrical lines (UG Cable and also the Sagged Overhead live lines in the street areas, periodical electrical panel maintenance the study adopts a risk-based approach that combines hazard identification, risk assessment, and control measures in line with standards. Through field observations, safety audits, and stakeholder interviews, the project evaluates the effectiveness of existing safety protocols and highlights gaps in implementation. The outcome will be a comprehensive safety management framework tailored for construction sites, focusing on proactive risk mitigation, training programs, personal protective equipment (PPE) compliance, and safety culture development. The findings aim to support construction firms in improving their safety performance, reducing accidents, and promoting a safer working environment. By enhancing safety protocols in the constructional packing unit, we can prevent workers life, save cost, machines and properties and also, we can enhance organization reputation among clients and people.

Keywords: *Constructional Packing Unit, Personal Protective Equipment (PPE), Space Hazards.*

OCCUPATIONAL NOISE EXPOSURE MEASUREMENT AND CONTROL IN THERMAL POWER PLANT

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ABSTRACT

Noise is a prevalent hazard in thermal power plants and workplaces worldwide, contributing significantly to occupational health risks such as noise-induced hearing loss. Prolonged exposure to elevated noise levels can lead to various health issues among workers, including hearing impairments, hypertension, annoyance, and decreased attention. The primary concern of chronic exposure to high sound levels is irreversible hearing loss due to damage to the stereocilia in the cochlea of the inner ear. In humans, the middle ear, along with the ear pinna, amplifies sound by up to 20 times, exposing the internal ear to potentially damaging pressures that can traumatize cochlear structures. Permanent damage to hearing tissues can occur when sound levels exceed 180 dB, although the maximum safe sound level is 140 dB. Implementing noise reduction techniques is crucial not only for mitigating these hazards but also for enhancing the well-being of workers and ensuring compliance with legal standards in thermal power plants.

Keywords: *Occupational Health Risks, Thermal Power Plants, Sound Level, Hearing Tissues*

ERGONOMIC WORKPLACE IMPROVEMENT IN FOOD PRODUCTION INDUSTRY

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ABSTRACT

The paper focuses on improving workplace safety in a major high-speed food processing facility. The primary objective was to apply theoretical safety knowledge to mitigate high-risk occupational hazards inherent to a complex manufacturing environment and contribute to the fortification of the site's Safety Management System (SMS). Methodologies employed include case study of previous accidents and near miss cases, Gaining knowledge in their Corrective and Preventive Action (CAPA), Hazard Identification and Risk Assessment (HIRA), Job Safety Analysis (JSA) for critical production lines. conducting comprehensive LOTO (Lockout/Tagout) program, checking Permits, Night visits, Critical safety Equipment, internal Audit and performing root cause analysis for all reported near-misses and first-aid incidents. Specific focus areas included machine guarding compliance, Bypass checking Staff and labour Unsafe Act and Unsafe conditions in the work floor checking and improving safety protocols in the high-heat oven and conveyor sections. The main objective of this work is to study and analysis the workplace area and apply academic knowledge to suggest better improvement techniques and process for less safety challenges.

Keywords: *Hazard Identification and Risk Assessment (HIRA), Job Safety Analysis (JSA)*

DIGITALIZED INSPECTION & MAINTAINING FOR EMERGENCY EQUIPMENT VIA CENTRALIZED MANAGEMENT DASHBOARD IN INDUSTRY

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ABSTRACT

Emergency equipment is essential for responding to incidents and must be regularly inspected to ensure proper functionality. In Phase-2, the QR-based emergency equipment monitoring system is enhanced with improved automation, real-time data access, and centralized management. Inspections are conducted to verify that equipment is free from damage or malfunction, and data is recorded through a centralized platform using industrial tablets or mobile devices. Each equipment item is assigned a unique QR code containing key details such as type, condition, expiry date, and service schedule. The system generates automated alerts for inspections and maintenance, reducing human error and ensuring timely servicing. It also enables efficient data retrieval, reporting, and compliance tracking through a centralized management portal. The system covers various emergency equipment, including Fire Extinguishers, Fire hydrants, SCBA, ELSA, Windssocks, Emergency assembly points, convex mirrors, and Emergency eye wash showers. This Phase-2 enhancement improves operational efficiency, data accuracy, and overall safety management in industrial environments.

Keywords: *Equipment Monitoring System, Centralized Management Portal, Maintenance*

INDUSTRIAL ACCIDENTS CAUSES AND CONTROL

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ABSTRACT

Industrial accidents are unintended sudden and undesirable events resulting in physical harm damage to machinery operational disruptions. They are rarely isolated events, stemming instead from complex interactions between human and technical organizations factors. Unsafe acts negligence lack of training, fatigue, stress and improper use of equipment and failure to use safety gear are primary causes. Unsafe conditions physical factors defective machinery poor maintenance inadequate, lighting, ventilation and hazards working environments. Management failure weak safety culture inadequate supervisions high production targets over safety and lack of safety policies. Root cause analysis deep evaluation of incidents to prevent resources. Safety management system implementing regulations safety audits and buildings a safety culture. training and educations ensuring workers and fully trained on machinery and safety protocols. Proper maintenance machine guarding and using updated infrastructure. Regulating compliance following strict legal safety guidelines and inspections.

Keywords: Maintenance, Fatigue Stress, Safety Guidelines, Safety Management

AI-DRIVEN MULTI-HAZARD RISK PREDICTION AND SAFETY OPTIMIZATION IN NATM AND TBM TUNNEL CONSTRUCTION

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ABSTRACT

Tunnelling using New Austrian Tunnelling Method (NATM) and Tunnel Boring Machine (TBM) is a critical infrastructure development tool, but at the same time, it is also highly vulnerable to various complex geotechnical uncertainties and dynamic operational hazards. Nevertheless, current baseline methods such as FMEA, Fishbone Analysis, and conventional risk assessment models are mostly static, single hazard-based, and not effective in handling real-time complex interactions, thus compromising the reliability of prediction in complex tunnelling environments. This research aims to propose an intelligent data-driven approach for multi-hazard risk prediction in tunnelling construction, referred to as Intelligent Tunnel Risk Prediction and Safety Optimization Framework (ITRPSOF). The ITRPSOF Framework primarily employs a Long Short-Term Memory (LSTM) model to handle real-time monitoring data, such as ground deformation, pore water pressure, vibration, and equipment parameters. To improve model robustness and prediction consistency, Gradient Boosting-based models such as XGBoost have also been employed as a baseline model and integrated within a hybrid model structure. In addition, an autoencoder-based anomaly detection model has also been integrated to identify early deviations from safe operating conditions, enabling timely intervention and proactive risk mitigation. The ITRPSOF framework has the potential to accurately predict critical events such as water ingress, tunnel collapse, and equipment failure, thus improving safety decision-making. The ITRPSOF Framework has a predicted accuracy of 98.7-98.9%, a false alarm rate below 1.8%, and a prediction error below 1.5% significantly improving safety and reliability in tunnel construction.

Keywords: Tunnel Construction Safety, NATM and TBM, Multi-Hazard Risk Prediction.

CONSTRUCTION SAFETY MANAGEMENT

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ABSTRACT

The aim of this research is to identify and evaluate the safety management in construction projects to minimize and control health and safety (H&S) of construction workers. Questionnaire is used to collect a wide range of opinions from experienced professionals working in different construction sites for comparison between them. Their views of the related literature are the first step in obtaining information from previously related studies. The literature reviews provide a theoretical background about safety management that guided the design of the questionnaire. This research concludes that the construction industry has a high number of fatalities and long-term injuries. This is unacceptable in a modern society and it also makes the industry inefficient, with days lost due to injuries. This research shows that the high rates of accidents are due to several common factors, such as poor construction planning, lack of safety in design, inadequate safety training, worker behavior, inherent safety H&S risk of construction and lack of knowledge of site rules.

Keywords: *Safety Management, Design of the Questionnaire, Modern Society, Hazards*

IMPLEMENTATION OF ADDITIVE MANUFACTURING IN BIO-MEDICAL APPLICATION FOR KNEE REPLACEMENT

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ABSTRACT

In recent years, the field of biomedical implants has experienced huge developments. Conventional methods of manufacturing are usually found unbefitting in fabricating complex geometries of biomedical implants. Newer and emerging technologies like additive manufacturing open wide scope by allowing complexity in geometry and huge reduction in manufacturing times. In this paper, we are going to design a prosthesis for knee joint fracture likely Osteoarthritis as a CAD model and fabricate it by Additive manufacturing process (like Fusion Deposition Modelling) using Polyurethane material which as used in many bio medical implants. It is necessary to change and improve existing technology and develop product with reasonably priced. So, it is necessary control the process parameter in any manufacturing process. An attempt is made to review the literature on optimizing the process parameters of rapid prototyping in orthopaedic implants. Taguchi method is applied for the process parameters and also need to determine which parameters are most significant for required output.

Keywords: Additive Manufacturing, Fusion Deposition Modelling, Polyurethane Material

AN INTELLIGENT IOT FRAMEWORK FOR REAL-TIME TEMPERATURE, HUMIDITY AND NOISE SURVEILLANCE USING ESP32

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ABSTRACT

The rapid growth of urbanization and industrialization has led to increasing environmental concerns, necessitating the development of efficient monitoring systems. This project presents the design and implementation of an Internet of Things (IOT)-based environmental monitoring system using the ESP32 microcontroller and a cloud-integrated web dashboard. The system is capable of measuring key environmental parameters such as temperature, humidity, air quality, and sound levels in real time. The hardware module consists of multiple sensors including a DHT11 sensor for temperature and humidity measurement, a gas sensor for air quality detection, and a sound sensor for noise level monitoring. These sensors are interfaced with the ESP32, which processes the data and transmits it to a cloud database using Wi-Fi connectivity. Firebase Real-time Database is utilized as the cloud platform to store and manage the data efficiently. A responsive web dashboard is developed using modern web technologies to visualize the collected data. The dashboard provides real-time updates, graphical analysis, and device status monitoring, enabling users to track environmental conditions remotely. Additionally, the system incorporates threshold-based alert mechanisms, where abnormal environmental conditions trigger visual alerts and buzzer notifications. An online/offline detection feature is also implemented to ensure system reliability by monitoring device connectivity. The proposed system offers a scalable, cost-effective, and efficient solution for continuous environmental monitoring. It can be applied in various domains such as smart homes, industrial safety systems, and urban environmental management. The integration of embedded systems, cloud computing, and web technologies demonstrates the effectiveness of IOT in building intelligent and automated monitoring solutions.

Keywords: IOT, Environmental Monitoring, ESP32, DHT11 Sensor, Air Quality, Sound Detection, Firebase, Smart Systems

SHAPE OPTIMISATION OF DISC BRAKE HOUSING

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ABSTRACT

The main objective is to optimize the size of disc brake housing to reduce the stresses in critical areas. Shape optimization of structures address the problem of determining the best shape for a given set of load conditions. Especially shape optimization becomes an important part of design process because the reliability is closely associated with the geometric shape. Stress distribution is one of the major problems in any component and it reduces the life of the component. So that the stress must be minimized. Local stress and displacement can be reduced in critical areas by modifying the contour of the structure. An effort had been made to minimize the material cost and increases the life of housing under maintaining the same structural performance by optimize the dimensions of a disc brake housing.

Keywords: *Brake Housing, Stress Distribution, Brake housing, Optimization*

DESIGN AND ANALYSIS OF RECHARGEABLE ELECTRIC VEHICLE

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ABSTRACT

A rechargeable Electric Vehicle (EV) is an advanced transportation system that uses electric energy stored in rechargeable batteries instead of conventional fossil fuels. With the increasing concerns about environmental pollution, global warming, and depletion of natural fuel resources, electric vehicles have emerged as a sustainable and eco-friendly alternative to traditional vehicles, rechargeable electric vehicle operate using electric motors powered by batteries that can be recharged from external power sources such as charging stations, household electricity supply, or renewable energy system like solar power. These vehicles help reduce greenhouse gas emission and contribute to a cleaner and healthier environment.

Keywords: *Electric Vehicle, Renewable Energy, Rechargeable Battery, Pollution Control*

MACHINING STUDIES OF FRICTION STIR WELDING (FSW) PROCESS BY TAGUCHI METHOD COUPLED WITH GREY RELATIONAL ANALYSIS (GRA)

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ABSTRACT

This study focuses on the optimization of friction stir welding (FSW) parameters for joining Aluminium 6061 alloy to achieve enhanced mechanical properties. FSW, a solid-state welding process, is widely recognized for producing defect-free joints with superior strength and minimal distortion compared to conventional fusion welding methods. In this work, key process parameters such as load, rotational speed, and traverse speed were systematically varied using a Taguchi L9 orthogonal array design of experiments. The welded specimens were evaluated through tensile testing and Vickers micro hardness analysis to assess their mechanical performance. The tensile test results revealed significant variation in yield strength, ultimate tensile strength, and elongation among the samples, indicating the strong influence of process parameters. Similarly, hardness measurements across different weld zones (base metal, heat-affected zone, weld top, and nugget zone) demonstrated improved hardness in the weld region due to microstructure refinement. To achieve multi-response optimization, Grey Relational Analysis (GRA) was employed, converting multiple performance characteristics into a single Grey Relational Grade (GRG). The results identified the optimal parameter combination corresponding to the highest GRG, indicating the best balance between tensile strength and hardness. Among the experimental trials, the condition with higher load and rotational speed exhibited superior overall performance. The study confirms that the integration of Taguchi method and GRA is an effective approach for optimizing FSW parameters and improving the mechanical behaviour of aluminium alloy joints, making it highly suitable for industrial applications in automotive, aerospace, and structural engineering sectors.

Keywords: *Frictions Stir Welding (FSW), Grey Relational Analysis (GRA), Aluminium Alloy*

DESIGN AND ANALYSIS OF VEHICLE ENGINE COOLING FINS AND COMPARISON WITH A MODIFIED FIN GEOMETRY

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ABSTRACT

Efficient thermal management is crucial for the performance and longevity of internal combustion engines. Cooling fins play a vital role in dissipating heat from the engine by increasing the surface area available for heat transfer. This study focuses on the design and analysis of conventional cooling fins and compares their performance with modified fin geometries to enhance heat dissipation efficiency. In this work, different fin profiles such as rectangular, triangular, and curved geometries are modelled and analyzed using computational methods. The thermal performance of each fin design is evaluated based on parameters such as temperature distribution, heat transfer rate, and efficiency. Modified fin geometry is proposed to improve airflow interaction and maximize heat transfer while maintaining structural integrity. The analysis is carried out using simulation tools under steady-state conditions, considering materials commonly used in engine fins such as aluminium alloys. Results indicate that the modified fin geometry provides improved heat dissipation compared to conventional designs, leading to better engine cooling performance. The study concludes that optimizing fin geometry significantly enhances thermal efficiency and can contribute to improved engine reliability and fuel efficiency.

Keywords: *Internal Combustion Engine, Aluminum Alloy, Computational Methods*

EFFECT OF COOLING MEDIUM TEMPERATURE ON FRICTION STIR WELDING OF AA5052 & AA6061 ON MECHANICAL PROPERTIES

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ABSTRACT

Friction Stir Welding (FSW) is an advanced solid-state joining process widely used for aluminum alloys due to its ability to produce high-quality welds with minimal defects. This study investigates the effect of cooling medium temperature on the mechanical properties of dissimilar friction stir welded joints of AA5052 and AA6061 aluminum alloys. The welding experiments were conducted by varying the temperature of the cooling medium while maintaining constant process parameters such as tool rotational speed, traverse speed, and axial force. The welded specimens were evaluated in terms of tensile strength, hardness, and microstructural characteristics. The results indicate that lower cooling medium temperatures increase the cooling rate, resulting in finer grain structures within the weld zone due to dynamic recrystallization. This leads to enhanced mechanical properties, including improved tensile strength and hardness. In contrast, higher cooling medium temperatures produce coarser grains and relatively lower mechanical performance. The study highlights the significant role of cooling conditions in controlling weld quality and optimizing the mechanical behavior of friction stir welded dissimilar aluminum joints.

Keywords: *Friction Stir Welding, AA5052, AA6061, Cooling Medium Temperature, Mechanical Properties, Microstructure, Dissimilar Welding.*

CHARACTERISTICS STUDY OF AL356/B4C METAL MATRIX COMPOSITE PRODUCED BY STIR CASTING TECHNIQUE

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ABSTRACT

In this research study, aluminium-aluminium oxide (Al-B,C) metal matrix composites (MMCs) of different percentage reinforcements of aluminium oxide were prepared. Three different types Al-B,C composite specimens having 2.5%, 5% and 7.5% volume fractions of aluminium oxide were fabricated using stir casting technique. These composite specimens were fabricated under different compaction loads. The effects of volume fraction of aluminium oxide particulates and compaction load on the properties of Al-B,C composites were investigated. The obtained results revealed that tensile and hardness of the composites are significantly influenced by volume fraction of aluminium oxide particulates. Results also showed that density, hardness and microstructure of Al-B,C composites are markedly influenced depending on the compaction load. The increase in the volume fraction of B,C enhances the density and hardness of the Al-B,C composites. It was found that, the composites show increased tensile and hardness as well as improved microstructure than the composites prepared. Moreover, optical micrographs revealed that aluminium oxide particulates are almost uniformly distributed in the aluminium matrix.

Keywords: Metal matrix composites - Aluminium oxide - Volume fractions - Tensile and Hardness – Microstructure.

HYBRID BATTERY THERMAL MANAGEMENT FOR ELECTRIC COMMERCIAL VEHICLES: INTEGRATING PCM AND LIQUID COOLING FOR ENERGY-EFFICIENT OPERATION

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ABSTRACT

Thermal management of lithium-ion battery systems is a critical challenge in electric commercial vehicles due to high load demands, extended duty cycles, and stringent safety requirements. Conventional cooling approaches, particularly liquid-based systems, effectively regulate temperature but often incur significant parasitic energy consumption. Conversely, passive methods such as Phase Change Materials (PCM) offer energy-efficient thermal buffering but lack dynamic control under varying operating conditions. This study proposes a hybrid battery thermal management system that integrates PCM with a controlled liquid cooling loop to achieve both temperature stability and energy efficiency. The system is modeled using a lumped thermal framework, where battery heat generation is balanced against heat dissipation through conduction and active cooling. A Proportional-Integral (PI) control strategy is implemented to regulate coolant flow, maintaining the battery temperature near an optimal setpoint while minimizing unnecessary pump operation. The performance of the hybrid system is evaluated against a conventional liquid-only cooling system under standard driving conditions, including Urban Dynamometer Driving Schedule (UDDS) and Highway Fuel Economy Test (HWFET) cycles. Key performance metrics include peak temperature, thermal stability, and cumulative coolant flow rate as a proxy for energy consumption. Simulation results demonstrate that the hybrid approach significantly reduces peak battery temperature and improves thermal stability while achieving measurable reductions in coolant flow demand, indicating enhanced energy efficiency. The integration of PCM effectively mitigates transient thermal spikes, enabling the control system to operate with improved efficiency and reduced energy overhead. The proposed methodology provides a scalable and energy-efficient solution for thermal management in electric commercial vehicles and contributes to the advancement of sustainable and safety-oriented design practices in next-generation electric mobility systems.

Keywords: *Electric Vehicles; Battery Thermal Management; Phase Change Materials (PCM); Liquid Cooling; PI Control; UDDS; HWFET; Energy Efficiency.*

ARTIFICIAL INTELLIGENCE DATA SCIENCE

DATA WAREHOUSE DESIGN AND ETL OPTIMIZATION FOR ENTERPRISE BUSINESS INTELLIGENCE

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ABSTRACT

Modern enterprises operate in highly digitized environments, generating massive volumes of data from diverse operational systems. While these systems excel at transaction processing, they are not designed for complex analytical queries or strategic decision-making. Organizations consequently face challenges such as fragmented data, inconsistent reports, and poor query performance. This project addresses these issues by implementing a centralized enterprise data warehouse designed to facilitate efficient Business Intelligence (BI) and advanced analytics. The proposed solution adopts a dimensional modeling methodology, specifically the Kimball approach, to structure data into fact and dimension tables. By employing star and snowflake schemas, the design supports efficient Online Analytical Processing (OLAP). Key entities include a fact_sales table and dimensions for customers, products, time, and regions. Star vs snowflake schema comparison for data organization outline diagram A robust Extract, Transform, and Load (ETL) pipeline was developed to integrate heterogeneous source systems. To ensure data integrity, a staging layer isolates raw data, performing schema validation and duplicate removal before it enters the warehouse. The ETL process utilizes incremental extraction to avoid full reloads, generates surrogate keys, and manages Slowly Changing Dimensions (SCD). Furthermore, optimization techniques—such as indexing foreign keys, partitioning fact tables by date, and pre-aggregation—were applied to enhance performance. The system culminates in interactive BI dashboards using tools like Power BI or Tableau to visualize KPIs, such as monthly revenue growth and regional performance. Evaluation results show significant improvements in query response times and data accuracy compared to traditional operational databases. Ultimately, this framework provides a scalable, reliable

Keywords: Data Warehouse, ETL Optimization, Business Intelligence, Dimensional Modeling, Star Schema, OLAP, Incremental Loading, KPIs, Data Integration, Performance Analytics.

ENHANCED HYBRID ML FRAMEWORK FOR EDGE-DEPLOYABLE PREDICTIVE MAINTENANCE IN INDUSTRY 4.0

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ABSTRACT

Predictive maintenance (PdM) is a cornerstone of Industry 4.0, aimed at enhancing operational efficiency and minimizing unplanned downtime through data-driven decision-making. Traditional maintenance strategies, such as reactive and preventive approaches, often lead to unexpected equipment failures and high operational costs. While existing hybrid machine learning (ML) solutions offer improved fault detection, they are frequently too computationally intensive and complex for real-time deployment on resource-constrained edge devices. This project proposes an enhanced hybrid ML framework that prioritizes model simplification, computational efficiency, and explainability. The system continuously monitors equipment health using IoT-based sensor data, specifically vibration, temperature, and pressure signals. To process this data, Seasonal-Trend decomposition (STL) is applied for noise reduction and trend extraction, followed by a lightweight hybrid architecture combining GRU-based residual modeling and Transformer-based forecasting. A key differentiator of this framework is its optimization for real-time industrial use. The model is refined using pruning and quantization techniques to achieve sub-100ms latency on embedded hardware while reducing resource consumption. Anomaly detection is managed via an adaptive switching mechanism, and SHAP-based explainability methods are integrated to provide human-interpretable insights into failure predictions. Validated on motor vibration datasets from the NASA bearing repository, the framework achieved 91% anomaly detection accuracy. Experimental results further demonstrate a 47% reduction in downtime and a 29% decrease in maintenance costs compared to conventional deep hybrid stacks. This research delivers a scalable, transparent, and resource-efficient PdM solution perfectly suited for modern smart factories.

Keywords: *Predictive Maintenance, Industry 4.0, Edge Computing, Hybrid Machine Learning, Model Quantization, Explainable AI (XAI), Anomaly Detection, IoT Sensors, STL Decomposition, Lightweight Deep Learning.*

SEMICONDUCTOR YIELD PREDICTION USING FEATURE ENGINEERING & ENSEMBLE LEARNING

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ABSTRACT

Semiconductor manufacturing is characterized by intricate processes where even minute variations in parameters can drastically impact product yield. Early and accurate yield prediction is vital for reducing production costs, maintaining high quality, and enabling timely corrective actions during the manufacturing cycle. The methodology begins with rigorous data preprocessing to address the complexities of manufacturing data. Techniques such as missing value handling and normalization are employed to ensure data consistency. To address the common issue of skewed data in manufacturing, Synthetic Minority Over-sampling Technique (SMOTE) is applied for class imbalance correction. Furthermore, feature engineering is utilized to extract meaningful representations from raw sensor signals, reducing dimensionality while preserving critical information. The project evaluates several machine learning architectures, including Random Forest, Support Vector Machines (SVM), and Naïve Bayes. Among these, ensemble-based models—which combine multiple learning algorithms to obtain better predictive performance—demonstrate superior accuracy and generalization. The experimental results indicate that this approach effectively classifies products into "pass" or "fail" categories with high precision. By providing reliable yield forecasts, this framework serves as a robust decision-support tool for semiconductor manufacturing environments.

Keywords: Semiconductor Manufacturing, Yield Prediction, Machine Learning, Ensemble Learning, Feature Engineering, SMOTE, Random Forest, High-Dimensional Data, Predictive Analytics, Process Control.

ANOMALY DETECTION FRAMEWORK FOR FINANCIAL TRANSACTIONS USING UNSUPERVISED LEARNING

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ABSTRACT

The rapid expansion of digital and mobile payment systems has significantly increased the risk of fraudulent activities, posing serious economic challenges to financial institutions and users. Traditional rule-based systems and standalone machine learning (ML) models often fail to adapt to evolving fraud patterns, frequently resulting in high false-positive rates or missed fraud cases. This project proposes a novel hybrid ML framework that integrates supervised learning and unsupervised anomaly detection to enhance detection accuracy while minimizing false alarms. The proposed system combines **XGBoost**, a gradient-boosting classifier trained on labeled transaction data, with **Isolation Forest**, an unsupervised model designed to identify anomalous behavior without prior fraud labels. The model leverages a comprehensive set of transactional and behavioral features, including transaction amounts, failed login attempts, transaction frequency, system latency, and time-based attributes. To address the inherent class imbalance in financial datasets, the **Synthetic Minority Over-sampling Technique (SMOTE)** is implemented. The outputs of both models are fused using a weighted ensemble mechanism. The final fraud score is determined by an adaptive weighting function that balances supervised probability and unsupervised anomaly scores, with an optimal decision threshold selected to maximize the F1-score. This integration ensures robustness against emerging fraud tactics that static models might miss. Experimental results demonstrate the superior effectiveness of this approach, achieving an exceptional **accuracy of 99.1%** and an **AUC-ROC of 0.996**. Feature importance analysis highlights that failed login attempts and transaction amounts are among the most critical indicators of fraudulent behavior. The framework is scalable and designed for real-time deployment, making it highly suitable for banking, fintech, and online payment systems.

Keywords: *Fraud Detection, Mobile Payments, Hybrid Machine Learning, XGBoost, Isolation Forest, Anomaly Detection, SMOTE, Financial Security, Real-Time Detection, Fintech.*

AI-BASED SHIFT OPTIMIZATION AND ATTRITION PREDICTION SYSTEM FOR BLUE-COLLAR WORKFORCE

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ABSTRACT

The study focuses on developing an intelligent system to optimize shift allocation and predict employee attrition in blue-collar workforce environments using Artificial Intelligence techniques. Managing shift schedules and workforce retention is a critical challenge in industries such as manufacturing, logistics, and retail, where inefficient scheduling and high attrition rates can significantly impact productivity and operational efficiency. This research aims to design and implement an AI-based shift optimization system that enhances workforce management through data-driven decision-making. The proposed system integrates machine learning algorithms, particularly Random Forest, to predict employee attrition based on various factors such as attendance, overtime, shift type, performance rating, and work patterns. Based on the predicted risk levels, an optimization model is applied to allocate shifts efficiently while considering constraints such as workload balance, employee preferences, and fatigue management. The system also includes data preprocessing, feature engineering, and visualization modules to provide meaningful insights for human resource decision-making. Experimental evaluation is conducted using real-time or simulated workforce datasets, and the performance of the model is assessed using metrics such as accuracy, precision, recall, and F1-score. The results demonstrate that the proposed system effectively reduces attrition risk and improves shift allocation efficiency. The findings contribute to the development of smart workforce management systems and provide a scalable solution for industries aiming to enhance productivity and employee satisfaction.

Keywords: *Artificial Intelligence, Shift Optimization, Blue-Collar Workforce, Attrition Prediction, Random Forest, Workforce Management, Data Analytics.*

DRIVER DROWSINESS DETECTION USING EYE TRACKING AND VOICE ALERT

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ABSTRACT

The study investigates the development of a real-time driver drowsiness detection system using computer vision-based eye tracking and voice alert mechanisms. Driver fatigue is a major cause of road accidents, particularly during long-duration and night-time driving. This research aims to enhance road safety by continuously monitoring the driver's eye movements and identifying drowsiness patterns. Experimental implementation involves capturing live video using a camera, followed by facial landmark detection and eye aspect ratio (EAR) analysis to determine eye closure behavior. When prolonged eye closure or abnormal blinking patterns are detected, the system triggers an immediate voice alert to regain driver attention. Structural analysis of the system includes performance evaluation based on detection accuracy, response time, and reliability under varying environmental conditions such as lighting. The results provide insights into the effectiveness of a non-intrusive, cost-efficient solution for real-time drowsiness detection. The findings contribute to the development of intelligent driver assistance systems, improving road safety and reducing fatigue-related accidents in practical applications.

Keywords: Driver Drowsiness Detection, Eye Tracking, Computer Vision, EAR, Voice Alert, Real-Time Monitoring

SMART FOREST SURVEILLANCE: REALTIME FIRE AND SMOKE DETECTION USING YOLO AND DEEP LEARNING

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ABSTRACT

Forest fires and smoke emissions threaten human lives, wildlife, ecosystems, and infrastructure, necessitating early and accurate detection. • Traditional sensor-based systems like temperature and smoke detectors are costly, require frequent maintenance, and are less effective in large forest areas. Image processing and deep learning techniques provide a reliable alternative, enabling wide area monitoring, real-time detection, and faster response. The proposed system applies pre processing and feature extraction to identify fire-like and smoke-like pixels, followed by YOLO-based classification for accurate detection. A mobile alert and alarm system is integrated to instantly notify authorities, ensuring rapid response and effective management of fire and smoke hazards.

Keywords: *This project develops an automated Smart Forest Surveillance system that utilizes YOLO-based deep learning to provide real-time fire and smoke detection for rapid early warning response.*

HR ANALYTICS SYSTEM FOR EMPLOYEE ATTRITION PREDICTION USING MACHINE LEARNING

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ABSTRACT

Employee attrition is one of the major challenges faced by organizations, as high turnover leads to increased recruitment costs, productivity loss, and knowledge gaps. Early identification of employees who are likely to leave can significantly help organizations design effective retention strategies. This project proposes an intelligent HR Analytics System for Employee Attrition Prediction using Machine Learning techniques. The system utilizes structured HR datasets containing employee demographic details, job-related attributes, performance metrics, and satisfaction indicators. Initially, data pre processing techniques such as missing value handling, encoding of categorical variables, and normalization are applied to improve data quality. To address high dimensionality and capture non-linear relationships among features, Kernel Principal Component Analysis (KPCA) is used for dimensionality reduction. Further, Adaptive K-Means Clustering is applied to group similar employees and identify hidden patterns within the workforce. This clustering process enhances data structure and removes inconsistencies before classification. Finally, Logistic Regression is implemented as the primary prediction model to estimate the probability of employee attrition (Leave/Stay). The system supports both real-time and batch prediction. A Flask-based web application enables HR personnel to input employee details and obtain immediate attrition risk predictions. Additionally, a Power BI dashboard provides interactive visualization of attrition trends, risk distribution, and key influencing factors. The proposed model improves predictive accuracy, supports data-driven decision-making, and enables organizations to take proactive measures to reduce employee turnover. Over all this system transforms traditional HR management into an intelligent, predictive, and analytics-driven approach.

Keywords: *Employee attrition, HR Analytics, Machine Learning, Kernel Principal Component Analysis, Power BI dashboard,*

HR ANALYTICS SYSTEM FOR EMPLOYEE ATTRITION PREDICTION USING MACHINE LEARNING

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ABSTRACT

Employee attrition is one of the major challenges faced by organizations, as high turnover leads to increased recruitment costs, productivity loss, and knowledge gaps. Early identification of employees who are likely to leave can significantly help organizations design effective retention strategies. This project proposes an intelligent HR Analytics System for Employee Attrition Prediction using Machine Learning techniques. The system utilizes structured HR datasets containing employee demographic details, job-related attributes, performance metrics, and satisfaction indicators. Initially, data preprocessing techniques such as missing value handling, encoding of categorical variables, and normalization are applied to improve data quality. To address high dimensionality and capture non-linear relationships among features, Kernel Principal Component Analysis (KPCA) is used for dimensionality reduction. Further, Adaptive K-Means Clustering is applied to group similar employees and identify hidden patterns within the workforce. This clustering process enhances data structure and removes inconsistencies before classification. Finally, Logistic Regression is implemented as the primary prediction model to estimate the probability of employee attrition (Leave/Stay). The system supports both real-time and batch prediction. A Flask-based web application enables HR personnel to input employee details and obtain immediate attrition risk predictions. Additionally, a Power BI dashboard provides interactive visualization of attrition trends, risk distribution, and key influencing factors. The proposed model improves predictive accuracy, supports data-driven decision-making, and enables organizations to take proactive measures to reduce employee turnover. Overall, this system transforms traditional HR management into an intelligent, predictive, and analytics-driven approach.

Keywords: Employee attrition, HR Analytics, Machine Learning, Kernel Principal Component Analysis, Power BI dashboard.

REAL-TIME WILDLIFE MONITORING AND INTRUSION DETECTION SYSTEM USING ADVANCED DEEP LEARNING (YOLOv11)

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ABSTRACT

Structured into four interconnected modules: Data Collection and Preprocessing, YOLOv11 Model Training, Real-Time Detection, and an Alert Mechanism & Dashboard. During development, datasets are collected and augmented for training the YOLOv11 model, which utilizes specialized C3k2 and C2PSA blocks to enhance feature extraction and attention mechanisms. The resulting real-time detection modules can receive feeds from webcams or IP cameras to predict color-coded bounding boxes and identify species such as tigers or elephants. Upon confirmed detection of a harmful animal, the system triggers the Twilio API to dispatch immediate SMS alerts to forest officials via an interactive Streamlit dashboard, with future development focusing on drone deployment and thermal imaging. The study addresses human-wildlife conflicts and safety threats resulting from wild life intrusion, which are often exacerbated by the limitations of traditional, manual, and delayed monitoring systems. A secure and innovative Real-Time Wildlife Monitoring and Intrusion Detection System is proposed, leveraging advanced Deep Learning technology, specifically the YOLOv11 architecture, to provide a reliable platform for the early and accurate detection of animals. The methodology is comprehensively

Keywords: Real-Time Monitoring, Intrusion Detection, Wildlife, Deep Learning, YOLOv11, C3k2, C2PSA, Twilio API, Streamlit, Human-Wildlife Conflicts, Automated Surveillance.

AIR QUALITY INDEX AND POLLUTION FORECASTING USING HYBRID DEEP LEARNING (CNN-LSTM)

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ABSTRACT

Air Quality Index (AQI) forecasting is crucial for urban air quality management and public health protection. This project proposes a hybrid deep learning model combining Convolutional Neural Networks (CNN) and Long Short-Term Memory (LSTM) networks, or alternatively CNN- BiLSTM architecture, to accurately predict AQI values and classify air quality into standard pollution categories. The hybrid approach leverages CNN's capability to extract spatial correlations among pollutants (PM2.5, PM10, NO2, SO2, O3, CO, and meteorological factors) while LSTM/BiLSTM captures long-term temporal dependencies in air quality data. The proposed CNN-LSTM/CNN-BiLSTM model is designed to forecast Air Quality Index for the next 24-72 hours with enhanced accuracy. Additionally, the model incorporates pollution category classification functionality to categorize AQI levels into standard categories (Good, Satisfactory, Moderately Polluted, Heavily Polluted, Severely Polluted). The performance of the hybrid deep learning model is rigorously evaluated and compared with traditional machine learning models including LSTM alone, Random Forest, XGBoost, and ARIMA. The results demonstrate that the CNN-LSTM/CNN-BiLSTM hybrid architecture significantly outperforms traditional methods in capturing complex spatial-temporal patterns.

Keywords: Air Quality Index, Hybrid Deep Learning, CNN-LSTM, CNN-BiLSTM, AQI Forecasting, Temporal Dependencies, Spatial Correlations, Pollution Forecasting, 24-72 Hour Prediction, AQI Classification, Attention Mechanism, Environmental Monitoring.

SCIENCE & HUMANITIES

IOT BASED BABY MONITORING SYSTEM FOR SMART CRADLE

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ABSTRACT

The “IoT-Based Baby Monitoring Cradle System” is an innovative smart solution designed to enhance infant care by integrating modern Internet of Things (IoT) technology with traditional baby cradle systems. This system aims to assist parents and caregivers by continuously monitoring the baby’s condition and ensuring safety, comfort, and well-being. In today’s fast-paced lifestyle, constant manual supervision of infants can be challenging; therefore, this intelligent system provides real-time monitoring and automated responses to support efficient childcare. The system is built on a scalable and efficient technological framework. It utilizes sensors such as temperature sensors, sound sensors, and motion detectors to track the baby’s environment and activities. A microcontroller (such as Arduino or NodeMCU) processes the collected data and communicates with a cloud platform through Wi-Fi connectivity. This enables real-time data transmission and remote access via a mobile application. Alerts and notifications are instantly sent to parents when abnormal conditions such as excessive crying, unsafe temperature levels, or unusual movements are detected. A key feature of the system is its automation capability. The cradle is equipped with an automatic swinging mechanism that is activated when the baby cries, helping to soothe the infant without manual intervention. Additionally, features like live video monitoring, humidity control, and sleep pattern analysis can be integrated to provide a comprehensive monitoring experience. The system ensures data security and reliability while maintaining ease of use for non-technical users. Designed with a user-centric approach, the IoT-based smart cradle offers convenience, safety, and peace of mind to caregivers. By combining real-time monitoring, automation, and intelligent alert systems, this project significantly improves infant care practices. Furthermore, it demonstrates the transformative potential of IoT in healthcare and smart home environments, paving the way for advanced, connected childcare solutions in the future.

Keywords: *IoT, Smart cradle System, Baby Monitoring, Sensors, Automation, Wireless communication, Embedde*

DRONE TECHNOLOGY

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ABSTRACT

Drone technology, or Unmanned Aerial Vehicles (UAVs), is emerging as a powerful solution for real-world problems when combined with smart systems and automation. This project proposes a Smart Drone System designed to support both agriculture and emergency rescue operations. The system uses GPS, sensors, and camera modules to perform tasks such as crop monitoring, pesticide spraying, and real-time surveillance. In agriculture, the drone helps farmers identify unhealthy crops, reduce manual labor, and improve productivity. In emergency situations like floods or accidents, the drone can quickly reach affected areas, capture live video, and assist in locating victims. The proposed system also integrates basic Artificial Intelligence concepts for obstacle detection and efficient path planning. This reduces human effort and increases accuracy. Compared to traditional methods, this solution is faster, safer, and more cost-effective. Although challenges such as battery life and regulations exist, continuous advancements in technology can overcome these limitations. This smart drone system demonstrates how modern innovation can be used to solve critical societal problems.

Keywords: UAV (Unmanned Aerial Vehicle), Smart Drone System, Agriculture Automation, Emergency Rescue, GPS & Sensors, Artificial Intelligence (AI), Crop Monitoring, Real-time Surveillance

GLOBAL SATELLITE COMMUNICATION NETWORKS

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ABSTRACT

Satellite communication is the process of transmitting information such as voice, video, data, and internet signals through artificial satellites placed in space. These systems can be controlled remotely or function autonomously using advanced software and programming. Drones are widely used in various fields such as agriculture, surveillance, disaster management, and delivery services, helping to reduce human effort and improve efficiency. The importance of drone technology increased significantly during the COVID-19 pandemic in 2020, where drones were utilized for monitoring public areas, delivering essential medicines, and spreading public awareness. This highlights their effectiveness in emergency situations. A typical drone consists of key components including a frame, motors, battery, GPS, and camera. The operation of drones involves coding and automation, using programming languages such as Python, C++, and Java. Additionally, software tools like ArduPilot, DroneKit, and Mission Planner are used for controlling and planning drone operations. Overall, drone technology plays a vital role in modern applications and continues to evolve as an important tool in various industries.

Keywords: UAV, Surveillance, Agriculture, Disaster, COVID-19, Tools, Programming languages, Drone operation, Various industries.

DATA STRUCTURE

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ABSTRACT

Data structures are a fundamental component of computer science, essential for efficient problem-solving and algorithm design. This paper focuses on analyzing the percentage distribution of data structure topics in academic and competitive examinations. It examines key areas such as arrays, linked lists, stacks, queues, trees, and graphs to identify their relative importance in question papers. By reviewing previous exam datasets, the study highlights recurring patterns and determines the weightage of each topic using statistical analysis. The results show that certain data structures, particularly trees and arrays, appear more frequently, indicating their practical significance.

Based on these findings, the paper suggests a strategic approach to learning, enabling students to prioritize high-weightage topics and improve performance. This research provides valuable insights for both students and educators, supporting effective preparation and curriculum planning. Overall, percentage-based analysis enhances understanding and promotes smarter, result-oriented learning.

Keywords: *Data Structures, Arrays, Linked Lists, Stacks, Queues*

EDGE COMPUTING BIG DATA

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ABSTRACT

Edge computing is a cutting-edge approach that handles data processing right at or near the source of data generation, instead of depending solely on centralized cloud servers. As the volume of data from devices like sensors, smartphones, and IoT gadgets continues to surge, traditional cloud systems face issues such as delays, bandwidth limitations, and security risks.

By shifting processing tasks to the network's edge, this technology enables faster responses, reduces network traffic, and improves overall system performance. It also enhances privacy by keeping sensitive information closer to where it's created. Edge computing is scalable and adaptable because it distributes workloads across many local devices, making it easier to grow and adjust to new demands. From a financial perspective, local data processing cuts down on bandwidth costs and lessens the need for extensive cloud resources. It also makes systems more reliable, as they can keep working even if internet connections drop temporarily. Additionally, processing data locally consumes less energy, which benefits both the environment and operational costs. This technology allows devices to make quick, context-specific decisions, which is essential for applications like smart cities, driverless cars, health monitoring, and factory automation. The rollout of 5G networks further boosts these capabilities by providing faster, more dependable connections, enabling exciting new possibilities. However, implementing edge computing comes with challenges, such as managing many distributed devices, ensuring security at each point, maintaining consistent data, and integrating with existing cloud systems. Despite these hurdles, edge computing is a vital technology that enhances data processing by making it faster, more efficient, and more reliable—paving the way for innovative digital solutions

Keywords: *Big data, Internet of Things, Real-Time Processing, Low Latency, Data security, Distributed Computing, Cloud Computing, Smart Systems, Network Efficiency*

PROTECTING DATE AND PRIVACY IN THE DIGITAL AGE

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ABSTRACT

In the digital age, cyber security and data privacy are often used interchangeably, but they represent distinct, symbiotic concepts. Cybersecurity is the practice of protecting computers, networks, and data from unauthorized access, attacks, and damage. In today's digital world, it plays a vital role in safeguarding personal information, financial data, and sensitive organizational records. Cybersecurity helps prevent cyber threats such as hacking, phishing, and malware attacks, ensuring privacy and data integrity. It is essential for individuals, businesses, and governments to maintain secure systems and build trust in digital technologies. As cyber threats continue to evolve, strong cybersecurity measures are necessary to ensure safe and reliable use of the internet.

Keyword: *Cybersecurity, Data Privacy, Network Security, Information Protection, Cyber Threats, Hacking, Phishing, Information Systems.*

AI IMPLEMENTED AGRICULTURE: REVOLUTIONIZING MODERN FARMING THROUGH DATA-DRIVEN INNOVATION

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ABSTRACT

Technology is rapidly transforming the way we farm, and Artificial Intelligence (AI) stands out as one of the most significant drivers of this revolution. Today, farmers are utilizing smart tools and advanced machinery that eliminate guesswork in crop management. Instead of relying on estimations, they can leverage digital systems and data analytics to precisely understand what their plants need to thrive. For example, AI-powered systems assist farmers in determining the optimal irrigation timing and exact water requirements, which conserves a valuable resource—water. These intelligent systems can detect early signs of pests or diseases, enabling timely intervention before the issues spread, thus minimizing crop loss. Furthermore, some machines are now capable of performing heavy tasks such as monitoring fields or applying pesticides and fertilizers, significantly reducing physical labor and improving efficiency. Ultimately, AI enhances crop yield and quality, while accelerating the farming process and reducing costs. It represents a simple yet powerful approach for the agricultural industry to work smarter, ensuring sustainable and productive food production in the face of global challenges.

Keywords: *AI Implemented Agriculture, Smart Farming Tools, Precision Irrigation, Crop Monitoring, Agricultural Automation, Crop Yield Optimization.*

CYBERSECURITY CHALLENGES IN THE DIGITAL ERA

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ABSTRACT

The rapid growth of digital technologies has transformed the way individuals, organizations, and governments operate. With the increasing use of cloud computing, artificial intelligence, Internet of Things (IoT), and big data, the digital era has brought significant benefits along with serious cyber security challenges. Cyber threats such as data breaches, ransomware attacks, phishing, identity theft, and malware have become more frequent and sophisticated. These threats not only affect businesses but also compromise personal privacy and national security. As organizations continue to adopt digital platforms, protecting sensitive information becomes a major concern. Weak security systems, lack of awareness, outdated software, and human errors often create vulnerabilities that cybercriminals exploit. Additionally, the rapid expansion of remote work and online services has increased the risk of cyber attacks, making cyber security a top priority in the digital age. This paper discusses the major cyber security challenges faced in the digital era and highlights the importance of implementing effective security measures. It also explores solutions such as strong authentication methods, encryption techniques, regular system updates, employee awareness training, and advanced security technologies. By understanding these challenges and adopting proactive strategies, organizations and individuals can better safeguard their digital assets and ensure a secure digital future.

Keywords: *Cybersecurity, Digital Era, Data Breaches, Cyber Attacks, Information Security, Cloud Security, Internet of Things (IoT), Ransomware, Data Privacy, Network Security*

PERSONALIZED MEDICINE

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ABSTRACT

Personalized medicine signifies a transformative strategy in contemporary healthcare, emphasizing the customization of medical treatments based on individual patient attributes through genetic, environmental, and lifestyle information. This paper evaluates the proportionate impact and efficacy of personalized approaches in comparison to conventional therapies. By analyzing recent clinical research and statistical data, it demonstrates how tailored treatments markedly enhance success rates, minimize adverse drug reactions, and improve patient outcomes. The study also investigates the expanding influence of advanced technologies such as genomics, artificial intelligence, and big data analytics in propelling this innovation. Findings reveal a substantial increase in treatment accuracy and patient satisfaction, underscoring the potential of personalized medicine to revolutionize healthcare systems worldwide. The conclusion suggests that integrating personalized approaches not only boosts clinical efficiency but also fosters a more predictive, preventative, and patient-focused medical paradigm.

Keywords: *clinical results, big data analysis, AI in medicine, predictive healthcare, medical innovation*

THE FUTURE OF INTERNET AND COMMUNICATION

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ABSTRACT

The future of the internet and communication is set to fundamentally revolutionize human connectivity and technological integration. Progressing from basic networks to high-speed 5G systems, the upcoming sixth generation—6G—will deliver ultra-low latency and flawless global connectivity. Artificial Intelligence (AI) will play a pivotal role in managing intelligent networks, predicting traffic patterns, and alleviating congestion. Additionally, the Internet of Things (IoT) will interconnect billions of devices, promoting the development of smart cities and automated industries. Innovative methods such as holographic communication and virtual reality (VR) will facilitate immersive digital environments, enhancing the realism of remote education and collaborative efforts. Quantum communication will strengthen security through nearly unbreakable encryption, while blockchain technology will ensure transparent and tamper-proof data exchanges. Furthermore, satellite-based systems aim to bridge connectivity gaps in remote and underserved areas. Despite these technological advancements, challenges related to cybersecurity, infrastructure costs, and ethical considerations must be carefully addressed. Ultimately, the future internet will be faster, more secure, and more accessible, playing a vital role in enhancing the quality of life worldwide.

Keywords: 5G systems, AI, 6G, virtual reality, block chain technology, cybersecurity

THE DEEP NATURAL FRAMEWORK FOR INTELLIGENT IMAGE AUTHENTICATION

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ABSTRACT

This paper introduces an innovative deep learning framework tailored for intelligent image authentication. In the era of exponential growth in digital media, establishing the authenticity of images has become an imperative challenge, as counterfeit or manipulated visuals can disseminate misinformation, undermine trust, and pose significant security risks. The proposed system harnesses cutting-edge Artificial Intelligence (AI) and deep learning methodologies to meticulously analyze image pixels and identify potential alterations or fabrications. The core of the framework employs Convolution Neural Networks (CNN), renowned for their exceptional prowess in image analysis, feature extraction, and pattern recognition at the granular pixel level. AI-driven processes involve extracting salient, high-level features while simultaneously detecting subtle inconsistencies and anomalies in pixel arrangements that may indicate tampering. To maximize performance, the system is extensively trained on a comprehensive and diverse image database, which enhances its accuracy, robustness, and generalization capabilities. This advanced approach is versatile and can be deployed across multiple sectors, including digital forensics, cyber security, social media content verification, and document authentication, thereby reinforcing the integrity and credibility of digital information. Ultimately, this framework aims to serve as a vital tool in combating digital deception and safeguarding the authenticity of visual content in an increasingly digital world.

Keywords: Artificial Intelligence deep learning, image authentication, convolutional natural network (CNN), Digital image processing image forgery detection, cyber security.

GENERATIVE AI AND NATURAL LANGUAGE PROCESSING

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ABSTRACT

Generative AI and Natural Language Processing (NLP) are vital technological advancements that enable computers to grasp and interact with human language more effectively. NLP empowers machines to interpret, comprehend, and respond to spoken or written language in a way that makes sense, supporting applications like chatbots, voice-controlled assistants, and language translation services. Meanwhile, Generative AI focuses on creating new content—such as texts, images, and sound—by producing outputs that resemble human-generated material.

When these technologies are combined, they allow machines to generate responses that are human-like, improving interactive experiences. For instance, applications like ChatGPT can answer questions, draft essays, and help users with everyday tasks. These innovations are extensively utilized in fields like education, healthcare, and business to enhance communication, optimize workflows, and save time. However, it is important for users to be cautious, as the information produced by these tools may sometimes be incorrect or misleading. Another significant benefit is that these technologies make information more accessible to everyone—helping students learn faster, companies better serve their customers, and individuals quickly find answers to their questions. As technology progresses, generative AI and NLP are expected to become even more powerful and integral parts of daily life.

Keywords: *Generative AI, Natural Language Processing (NLP), Chatbots, Machine Learning, Human Language, Automation, Communication, Technology*

ARTIFICIAL INTELLIGENCE (AI), MACHINE LEARNING (ML), AND DATA SCIENCE

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ABSTRACT

Artificial Intelligence (AI), Machine Learning (ML), and Data Science (DS) are swiftly advancing disciplines that are revolutionizing industries and changing how data is leveraged for strategic decisions. AI involves creating machines that mimic human intelligence, capable of tasks like reasoning, learning, and problem-solving. ML, a branch of AI, centers on designing algorithms that allow systems to learn from data and enhance their performance over time without needing explicit instructions. Data Science focuses on extracting valuable insights and knowledge from both structured and unstructured data through statistical, analytical, and computational methods. These three fields collectively play vital roles across sectors such as healthcare, finance, education, and transportation. They facilitate predictive analytics, automation, personalized experiences, and smarter decision-making. As data volumes grow exponentially, these technologies enable organizations to discover hidden patterns, streamline operations, and maintain a competitive edge. However, challenges like data privacy issues, ethical considerations, and the necessity for high-quality data pose significant hurdles. Overcoming these obstacles is crucial for the responsible deployment and effectiveness of AI-based solutions. As AI, ML, and DS evolve, they offer tremendous potential to foster innovation and address complex real-world challenges.

Keywords: Artificial intelligence, Machine Learning, Data Science, Data Analysis, Deep Learning, Automation

AN INTELLIGENT IOT-ENABLED WEARABLE SYSTEM FOR ENHANCING WOMEN SAFETY WITH REAL-TIME TRACKING

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ABSTRACT

Women's safety has become a major concern in modern society, especially with increasing incidents of harassment and violence. This paper presents an intelligent IoT-enabled wearable system designed to enhance women safety through real-time tracking and emergency alert mechanisms. The proposed system integrates GPS and GSM technologies to continuously monitor the user's location and transmit it to predefined contacts during emergency situations. The wearable device is equipped with sensors and a panic button, which when activated, sends instant alerts along with the user's real-time location to family members and nearby authorities. Additionally, the system can include features such as voice activation, health monitoring, and mobile application integration for improved usability and quick response. Experimental results demonstrate that the system is reliable, cost-effective, and efficient in providing immediate assistance, thereby improving personal safety and security. This solution aims to empower women by leveraging modern IoT technologies for proactive protection.

Keywords: *IoT, Women Safety, Wearable Device, GPS Tracking, GSM Communication, Emergency Alert System, Real-Time Monitoring.*

SMART VEHICLE SAFETY SYSTEM FOR DETECTING AND PREVENTING DRUNK DRIVING

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ABSTRACT

Drunk driving is one of the major causes of road accidents, leading to significant loss of life and property. This paper presents a smart vehicle safety system designed to detect and prevent drunk driving using an alcohol detection sensor. The system uses a microcontroller integrated with an alcohol sensor to monitor the driver's breath alcohol level. If the detected value exceeds the safe threshold, the system prevents the engine from starting and alerts the user. Additional features such as buzzer alerts and real-time monitoring improve safety. The proposed system is cost-effective, reliable, and easy to implement, making it suitable for modern vehicles to enhance road safety and reduce accidents caused by intoxicated drivers.

Keywords: *Drunk Driving Detection, Alcohol Sensor, Embedded System, Vehicle Safety, Ignition Control, Road Safety*

SMART IRRIGATION SYSTEM FOR PRECISION AGRICULTURE USING IoT AND SENSOR-BASED CONTROL

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ABSTRACT

This study focuses on the development of a smart irrigation system for precision agriculture using Internet of Things (IoT) and sensor-based control technologies. Efficient utilization of water resources has become a critical concern in modern agriculture due to increasing water scarcity and the need for sustainable farming practices. Traditional irrigation methods often result in excessive water usage and require continuous human intervention. To overcome these challenges, the proposed system is designed to automate irrigation based on real-time environmental and soil conditions. The system incorporates soil moisture sensors, temperature sensors, and humidity sensors to continuously monitor the field parameters. The collected data is processed by a microcontroller, which determines the water requirements of the crops. Based on this analysis, the system automatically controls the irrigation process by switching the water pump on or off. Additionally, IoT integration allows farmers to remotely monitor field conditions and control irrigation through mobile or web-based applications. Experimental testing of the system demonstrates its effectiveness in reducing water wastage, minimizing manual labor, and improving crop productivity. The system is cost-effective, easy to implement, and scalable for different agricultural environments. Overall, this smart irrigation solution contributes to sustainable agriculture by ensuring efficient water management and enhancing precision farming techniques.

Keywords: *Smart Irrigation, Precision Agriculture, Internet of Things (IoT), Soil Moisture Sensor, Automation, Water Management, Sensor-based Control, Remote Monitoring*

AUTOMATIC FAULT DETECTION AND CONTROL SYSTEM FOR LOOM MACHINE

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ABSTRACT

The textile industry heavily depends on loom machines for continuous fabric production. However, unexpected machine faults such as thread breakage, excessive vibration, motor overheating, and mechanical overload can lead to fabric damage, production loss, increased maintenance cost, and safety risks for operators. Manual monitoring of loom machines is inefficient and may not detect faults immediately. Therefore, an automatic fault detection and control system is essential to improve operational reliability and efficiency. This project proposes the design and implementation of an Automatic Fault Detection and Control System for a loom machine using embedded system technology. Various sensors such as thread break sensors, vibration sensors, temperature sensors, and current sensors are used to continuously monitor machine conditions in real time. The collected data is processed by a microcontroller which compares the sensor values with predefined threshold limits. When any abnormal condition is detected, the system automatically stops the loom machine through a relay control mechanism and activates an alert system using a buzzer and display unit. The proposed system minimizes fabric wastage, reduces downtime, enhances worker safety, and improves overall productivity in textile industries. Additionally, the system can be extended with IoT technology for remote monitoring and predictive maintenance. This automation-based approach provides a cost-effective and reliable solution for modern smart textile manufacturing environments.

Keywords: *Automatic Fault Detection, Loom Machine Automation, Embedded System, Industrial Automation, Sensor Monitoring, Machine Safety, Textile Industry, Motor Control System, Predictive Maintenance.*

AN INTELLIGENT RAILWAY SAFETY SYSTEM USING SENSOR FUSION FOR REAL-TIME OBSTACLE DETECTION

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ABSTRACT

The study presents the development of an intelligent railway safety system using sensor fusion techniques for real-time obstacle detection. Railway accidents caused by unexpected obstacles on tracks pose significant safety challenges and require advanced monitoring solutions. This research focuses on integrating multiple sensors such as ultrasonic sensors, infrared sensors, and cameras to enhance detection accuracy and reliability. The system collects data from different sensors and processes it using sensor fusion algorithms to identify obstacles under various environmental conditions. Experimental analysis is carried out to evaluate the performance of the proposed system in detecting objects at different distances and speeds. The system is designed to provide early warnings to train operators and automatically trigger safety mechanisms to prevent collisions. Performance evaluation includes accuracy, response time, and reliability of detection under diverse scenarios. The results demonstrate that the sensor fusion approach significantly improves obstacle detection efficiency compared to single-sensor systems. This work contributes to improving railway safety by enabling timely decision-making and reducing the risk of accidents in real-time applications.

Keywords: *Sensor Fusion, Railway Safety, Obstacle Detection, Real-Time Monitoring, Intelligent System, Ultrasonic Sensor, Infrared Sensor.*

DESIGN OF A SMART VEHICLE COLLISION AVOIDANCE SYSTEM USING DISTANCE AND SPEED MONITORING

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ABSTRACT

The rapid increase in vehicle usage has led to a significant rise in road accidents, making road safety a major concern worldwide. This project presents the design of a Smart Vehicle Collision Avoidance System using distance and speed monitoring to enhance driving safety and reduce the risk of accidents. The system primarily focuses on detecting obstacles in front of the vehicle and analyzing the relative speed between vehicles to provide timely warnings or automatic control actions. The proposed system utilizes sensors such as ultrasonic or radar sensors to continuously measure the distance between the host vehicle and nearby objects. Simultaneously, speed sensors monitor the velocity of the vehicle. A microcontroller processes this real-time data and calculates the safe stopping distance based on current speed. If the detected distance falls below a predefined safety threshold, the system alerts the driver through visual and audible warnings. In critical situations, the system can also trigger automatic braking to prevent collisions. Overall, this smart collision avoidance system enhances vehicle safety, minimizes accident risks, and contributes to the development of advanced driver assistance systems (ADAS), paving the way toward safer and smarter transportation..

Keywords: Smart Vehicle System, Collision Avoidance, Distance Monitoring, Speed Monitoring, Ultrasonic Sensor, Radar Sensor, Microcontroller, Automatic Braking System, Driver Assistance System (ADAS), Road Safety, Obstacle Detection, Real-Time Monitoring, Intelligent Transportation System (ITS).

SMART AI HEALTH CARE FOR GEN Z IN PUBLIC PLACES

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ABSTRACT

With the rapid advancement of artificial intelligence (AI), healthcare services are becoming more accessible, efficient, and personalized. This project focuses on the development of a Smart AI Healthcare System tailored for Generation Z, particularly in public places such as malls and bus stands where immediate medical assistance is often unavailable. Generation Z individuals are highly tech-savvy and prefer quick, digital-first solutions. This system integrates AI-powered health monitoring tools, IoT-enabled devices, and real-time data analysis to provide instant health assessments. The proposed model includes features such as automated symptom detection, vital sign monitoring (heart rate, temperature, oxygen levels), and AI-based recommendations. These systems can be installed in public spaces to act as first-response healthcare units, reducing delays in medical intervention. The system uses machine learning algorithms to analyze user inputs and sensor data, offering preliminary diagnosis and suggesting necessary actions. In case of emergencies, it can automatically alert nearby hospitals or emergency services. Additionally, it maintains user privacy through secure data handling techniques. This solution not only enhances public health infrastructure but also aligns with the digital habits of Gen Z, ensuring higher engagement and usability. The implementation of such AI-driven healthcare kiosks can significantly reduce risks associated with delayed medical care in crowded public environments.

In conclusion, Smart AI Healthcare systems in public places provide a cost-effective, scalable, and efficient solution to bridge the gap between individuals and immediate healthcare access, ultimately improving public safety and well-being.

Keywords: *Artificial Intelligence, Smart Healthcare, Generation Z, Public Health, IoT, Machine Learning, Emergency Response, Health Monitoring*

A SMART WEARABLE DEVICE FOR REAL-TIME CHILD TRACKING AND EMERGENCY ALERT SYSTEM

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ABSTRACT

The proposed smart wearable device is designed to enhance child safety through real-time tracking and an integrated emergency alert system. This device utilizes technologies such as GPS, GSM, and IoT to continuously monitor a child's location and transmit accurate data to a parent's mobile application. In case of emergencies, the device features a panic button that instantly sends alerts along with location details to predefined contacts. Additionally, geofencing capabilities notify parents when a child enters or exits a designated safe zone. The system is compact, user-friendly, and energy-efficient, making it suitable for daily use. By combining real-time monitoring with instant communication, the device aims to reduce response time during critical situations and provide peace of mind to caregivers. This solution addresses growing concerns about child safety by offering a reliable and accessible technological approach for protection and supervision.

Keywords: Smart wearable device, Child safety, Real-time tracking, GPS, GSM, IoT, Emergency alert system, Geofencing, Panic button, Mobile application

CLOUD COMPUTING AND FUTURE DATA STORAGE

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Abstract

Cloud computing has transformed the way organizations store, manage, and access data. Instead of relying on traditional physical storage systems, cloud computing provides scalable, flexible, and cost-effective solutions through the internet. This technology enables businesses and individuals to store large volumes of data securely while accessing it anytime and anywhere. Major cloud service providers such as Amazon Web Services, Microsoft Azure, and Google Cloud have played a significant role in advancing cloud infrastructure and services. Future data storage in cloud computing is expected to become more intelligent, efficient, and secure with the integration of emerging technologies like artificial intelligence, edge computing, and quantum computing. These innovations will improve data processing speed, reduce storage costs, and enhance security measures. Additionally, cloud storage will support the growing demand for big data, Internet of Things (IoT), and real-time analytics. In conclusion, cloud computing is shaping the future of data storage by offering reliable, scalable, and innovative solutions. As technology continues to evolve, cloud computing will remain a key component in managing the rapidly increasing volume of digital data and supporting modern digital transformation.

Keywords: Cloud Computing, Data Storage, Future Storage Technologies, Artificial Intelligence, Edge Computing, Quantum Computing, Big Data, Internet of Things (IoT), Data Security, Scalable Storage

IOT BASED SOLAR-BASED E-UNIFORM FOR SOLDIERS

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ABSTRACT

The "IoT-Based solar-Based E-Uniform for Soldiers is an innovative and intelligent solution designed to enhance the safety, efficiency, and operational capability of military personnel by integrating renewable energy technology with wearable systems. This system utilizes solar energy to power embedded electronic components within the soldier's uniform, reducing dependency on conventional batteries and ensuring uninterrupted energy supply in remote or battlefield environments. The proposed system incorporates flexible solar panels integrated into the fabric of the uniform, which harvest solar energy during daytime operations. The collected energy is stored in lightweight rechargeable batteries and used to power various electronic devices such as communication modules, GPS tracking systems, health monitoring sensors, and emergency alert systems. Sensors embedded in the uniform continuously monitor vital parameters like body temperature, heart rate, and environmental conditions, providing real-time data to command centers. A microcontroller unit processes the collected data and enables wireless communication through IoT-based technology. In case of emergencies such as injury, abnormal health conditions, or hostile environments, the system automatically sends alerts along with the soldier's location. This enhances quick response and decision-making in critical situations. Additionally, the uniform is designed to be lightweight, durable, and suitable for harsh weather conditions, ensuring comfort and reliability for soldiers

Keywords: *Solar Energy, E-Uniform, Soldiers, IOT, Wearable Technology, Health Monitoring, GPS Tracking, Renewable Energy, Embedded Systems.*

CYBERSECURITY PHISING AWARENESS WEB SITE

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ABSTRACT

In the contemporary digital era, the rapid expansion of internet – based services, cloud computing, and online communication platforms has significantly increased the exposure of users to a wide range of cyber threats. Cyber security has become a critical concern due to the growing number of attacks such as phishing, weak password exploitation, malicious website access, and unauthorized data breaches. These threats not only compromise user privacy but also affect the confidentiality, integrity, and availability of sensitive information. This paper presents the design and development of an integrated Cyber security Tool kit aimed at providing a comprehensive and user – friendly solution to address common security vulnerabilities. The proposed system is composed of four major modules: a Password Strength Checker , a Phishing Awareness System, a URL Safety Checker, and a File Encryption Tool. The Password Strength Checker evaluates the strength of user passwords based on parameters such as length, complexity, and randomness, and provides suggestions to enhance password security. The Phishing Awareness System identifies suspicious emails and messages by detecting common phishing patterns, including misleading links and abnormal communication behavior, thereby alerting users to potential threats. The URL Safety Checker analyzes web links using predefined rules and security indicators to determine their legitimacy and prevent access to malicious or fraudulent websites. Additionally, the File Encryption Tool secures sensitive data by applying cryptographic techniques that convert information into an unreadable format, ensuring that only authorized users can access it. The integration of these modules forms a multi-layered security framework that effectively addresses both technical and human aspects of cyber security. The system not only enhances data protection but also promotes user awareness regarding safe online practices. It is designed to be efficient, scalable, and easy to use, making it suitable for both technical and non-technical users. By combining preventive, detective, and protective mechanisms, the proposed solution significantly reduces the risk of common cyber attacks. In conclusion, this project demonstrates a practical and effective approach to improving digital security through an integrated platform. The Cyber security Toolkit contributes to building a safer digital environment by minimizing vulnerabilities and strengthening user level security. Future enhancements may include the incorporation of machine learning techniques for

advanced threat detection and real-time monitoring capabilities to further improve system performance and adaptability.

Keywords: *Cyber security, Intrusion Detection Systems (IDS), Cryptographic Algorithms, Secure Authentication, Phishing Detection, Malicious URL Analysis, Data Encryption, Information Security, Threat Intelligence, Secure Data Transmission.*

MASTER OF BUSINESS ADMINISTRATION

A COMPARATIVE STUDY ON GREEN BANKING PRACTICES IN INDIAN BANK AND KARUR VYSYA BANK

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ABSTRACT

Environmental sustainability has become a major global concern, and different sectors are expected to contribute toward protecting the environment. The banking sector also plays an important role in this process through the adoption of green banking practices. Green banking refers to the use of environmentally friendly banking operations that reduce paper consumption, promote digital transactions, and support sustainable development. By encouraging services such as internet banking, mobile banking, and electronic statements, banks can minimize their environmental impact while improving operational efficiency. The present study examines the green banking activities of public sector banks in Tamil Nadu and analyses the level of awareness among bank customers regarding these services. The study is based on both primary and secondary data. Primary data were collected through a structured questionnaire from selected bank customers, while secondary data were obtained from books, journals, and published reports related to green banking. The results of the study indicate that many customers are familiar with basic green banking services such as ATM usage, internet banking, and mobile banking. These services help reduce the use of paper and contribute to environmentally responsible banking practices. However, the study also shows that awareness of some advanced green banking initiatives is still limited among customers. The study concludes that green banking is an important step toward promoting sustainable development. Banks need to create greater awareness and encourage customers to actively adopt eco-friendly banking services in order to support environmental protection and sustainable economic growth.

Keywords: *Green Banking, Sustainable Development, Banking Services, Environmental Sustainability, Tamil Nadu*

PREDICTIVE ANALYTICS AN OVERVIEW OF EVOLVING TRENDS AND METHODOLOGIES

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ABSTRACT

This paper provides a concise examination of predictive analytics, a discipline crucial for forecasting. Future trends by analyzing existing data through statistical and machine learning techniques. Our focus is on the practical applications of predictive analytics across various domains, including finance, healthcare, and risk management, underscoring its role in strategic decision-making. We detail the integral stages of predictive analytics, beginning with the clear articulation of the problem statement, an essential precursor to effective analysis. The gathering and preparation of data follow, emphasizing the need for high-quality, relevant data sets and addressing the intricacies of data cleansing and transformation. The heart of predictive analytics lies in the development and tuning of models tailored to the data and problem at hand. This paper navigates through the selection and application of diverse algorithms, from simple regressions to sophisticated ensemble methods, and highlights the iterative nature of model optimization. Finally, we discuss the deployment phase, which involves integrating the predictive model into real-world applications, and acknowledge additional steps that may be necessary depending on the problem's context. Concluding with a nod to the future, the paper positions the reader at the starting line, ready to delve into the creation of their predictive models, armed with a solid understanding of the core processes of predictive analytics.

Keywords: *Analytics, Bigdata, Deep Learning; Machine Learning, Regression*

A STUDY ON ENTREPRENEURSHIP DEVELOPMENT

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ABSTRACT

The economic development of any nation is dependent upon the purposeful human activity, that is, entrepreneurial function. Entrepreneurship has come to be perceived as the engine of economic and social development throughout the world. Entrepreneurs have become the backbone of industrial development. Thus, the efforts are undertaken by the respective governments for the development of entrepreneurs which are popularly known as Entrepreneurship Development Programmes (EDPs). Entrepreneurship development is an educational process and an endeavour in human resource development. The relevance of EDPs is that entrepreneurs are not just born but can be developed and trained to undertake ventures and be creative. The significance of EDPs has been recognised world over, both in developed and developing countries. The aim of EDPs is to create an entrepreneurial culture and develop a healthy small business sector to facilitate the economic development. EDPs, if results in the development of an entrepreneurial culture can be a solution for many of the problems confronted by an economy. EDPs enable prospective entrepreneurs in the setting up of their own units, thus creating employment opportunities. EDPs also assists in accelerating the pace of industrialisation in the backward areas by setting up small scale units in industrially backward and remote areas thus ensuring a balanced regional development. Thus, it results in utilisation of local resources, increasing the standard of living and facilitating the overall development.

Keywords: Growth and Development Model, Sophisticated, Theoretical Framework, Economic Development, Entrepreneurship Development Programmes, EDP

AN EMPIRICAL INVESTIGATION OF MARKET RISK AND RETURN BEHAVIOR IN THE INDIAN AUTOMOBILE SECTOR

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ABSTRACT

The automobile sector is a key contributor to economic growth, supported by strong industrial linkages and significant employment generation. It also plays an important role in overall market performance. This study is based on secondary data collected from the National Stock Exchange (NSE). A sample of 10 automobile sector companies [Ashok Leyland, Eicher Motors, Exide Industries, Bosch, TVS Motor Company, Maruti Suzuki, Mahindra & Mahindra, Bajaj Auto, Hero MotoCorp, and Samvardhana Motherson] is analyzed over a five year period (2020–2025). The analysis uses tools such as risk and return analysis, standard deviation, beta, and outperformance analysis, with benchmarks like the Nifty 50 and Nifty Auto Index. Standard deviation measures volatility, beta indicates market sensitivity, and outperformance analysis identifies stocks that perform better than benchmark indices, providing an understanding of risk–return behavior. The results show that the stocks exhibit varying levels of risk and return, with some showing stable performance and others higher volatility. The study emphasizes the importance of risk evaluation, diversification, balanced portfolio management, and regular monitoring for better investment decisions and long-term growth. In conclusion, stocks such as Mahindra & Mahindra, Maruti Suzuki, TVS Motor Company, Bajaj Auto, and Eicher Motors show relatively strong performance, while Samvardhana Motherson, Hero MotoCorp, and Ashok Leyland require cautious investment.

Keywords: *Risk analysis, Return analysis, Outperformance, Beta, Standard Deviation, Portofolio Diversification, Market Volatility, Investment Decision Making.*

TRAINING AND DEVELOPMENT AND ITS IMPACT ON EMPLOYEE PERFORMANCE

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ABSTRACT

Training and Development play a vital role in enhancing employee performance and ensuring organizational success in today's competitive business environment. Organizations are increasingly investing in structured training programs to equip employees with the necessary knowledge, skills, and abilities required to perform their jobs effectively. This study focuses on examining the impact of training and development initiatives on employee performance, highlighting how these programs contribute to both individual growth and overall organizational productivity. The primary objective of this study is to analyze how training programs influence employee efficiency, job satisfaction, and skill enhancement. Effective training helps employees adapt to technological advancements, improve their competencies, and perform tasks with greater accuracy and confidence. The findings indicate that employees who undergo regular training programs demonstrate higher levels of performance, better problem-solving abilities, and increased commitment toward organizational goals. Moreover, training enhances employee morale and reduces workplace errors, leading to improved efficiency and effectiveness. In addition, the study highlights that well-designed training programs aligned with organizational objectives significantly contribute to employee retention and engagement. However, the effectiveness of training depends on proper need assessment, program design, and evaluation mechanisms. In conclusion, training and development are essential tools for improving employee performance and achieving organizational excellence. Organizations must continuously invest in employee development initiatives to remain competitive and ensure long-term success.

Keywords: *Training and Development, Employee Performance, Skill Enhancement, Productivity, Job Satisfaction, Employee Motivation, Organizational Effectiveness, Learning and Development.*

A STUDY AN WAREHOUSE MANAGEMENT

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ABSTRACT

This study is designed to explore overall of warehouse management practice in the companies and help identify the scope of improvements. To reach the said objectives, the study intends to use qualitative research model which was mainly based on secondary sources were also used and observation research methodologies (includes books, articles, literary works, etc.) were also used to support the conclusion and recommendations made. In addition, existing performance of Warehouse Management is not that much satisfactory in terms of efficiency and effectiveness in comparison with the present standards of similar industry. Therefore, based on the response of the respondents', observation and literature review problems are identified and conclusions are drawn. It provides service and controls function of the flow of materials entering and distributed at a company. It provides service and controls function of the flow of materials entering and distributed at a company. In general, this study is expected to be helpful for the policy makers to improve the existing performance of Association.

Keywords: *Warehouse, Scope, Function, Materials, Management, Practices, Review of literature, Performance*

A STUDY ON EMPLOYEE PERFORMANCE TOWARDS ORGANIZATIONAL GOALS (HR) – MENAKA MILLS PVT LTD, THENI

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ABSTRACT

Employee performance is a critical determinant of organizational success, as it directly affects productivity, efficiency, and the achievement of strategic objectives. In the competitive textile industry, companies like MENAKA MILLS PVT LTD rely heavily on the effective contribution of their workforce to meet production targets, maintain quality standards, and enhance overall organizational performance. This study focuses on evaluating how employee performance aligns with the organization's goals and the role of HR practices in promoting efficiency and engagement. The research aims to identify the key factors influencing employee performance, including motivation, leadership, training, work environment, and recognition. Data was collected through structured questionnaires, interviews, and observations of employees across different departments of MENAKA MILLS. By analyzing this data, the study provides insights into the effectiveness of HR strategies in enhancing employee productivity and satisfaction. The findings highlight the correlation between employee engagement and organizational goal achievement. It was observed that employees who receive proper guidance, training, and recognition demonstrate higher commitment, better teamwork, and increased productivity. Conversely, gaps in communication, inadequate motivation, or insufficient HR support were found to negatively impact performance and goal alignment.

Keywords: *Employee Performance, Organisational goals, Productivity, Job satisfaction Performance appraisal, Employee engagement, Training and development.*

A STUDY ON ORGANIZATION CULTURE TOWARDS POTENTIAL OUTCOMES IN HIRANMAYEE RUBBER PVT.LIMITED, MADURAI

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ABSTRACT

The manufacturing sector plays a vital role in the economic development of the country, and the rubber products industry is an important part of this sector. Hiranmayee Rubber Private Limited, located in Madurai, Tamil Nadu, is a manufacturing company engaged in producing high-quality rubber and rubberbased industrial components. This internship project was undertaken with the objective of gaining practical exposure to the industrial environment and understanding the overall functioning of a rubber manufacturing organization. Hiranmayee Rubber Private Limited was incorporated in the year 2016 and operates as a private limited company. The company specializes in the manufacturing of rubber products such as oil seals, O-rings, gaskets, and other customized rubber components. These products are widely used in automotive industries, engineering units, machinery manufacturing companies, and other industrial applications. The company focuses on delivering quality products that meet customer specifications and industrial standards. During the internship period, an opportunity was provided to observe and understand the complete manufacturing process, starting from raw material procurement to the final dispatch of finished goods.

Keywords: *Organizational Culture, Employee Performance, Job Satisfaction, Employee Engagement, Leadership Style, Organizational Effectiveness, Teamwork,*

A STUDY ON EMPLOYEE ENGAGEMENT IN LUFT TECH EQUIPMENTS, COIMBATORE

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ABSTRACT

This internship project was carried out at Luft Tech Equipments, located in Ondiputhur, Coimbatore, Tamil Nadu. Luft Tech Equipments is a business-to-business (B2B) industrial solutions provider specializing in air filtration systems and related industrial equipment. The company primarily caters to manufacturing units, commercial facilities, and industrial organizations that require clean air solutions to improve operational efficiency, product quality, and workplace safety. The objective of this internship was to gain practical exposure to industrial operations, understand business processes, and analyze the role of air filtration solutions in modern industries. During the internship period, emphasis was placed on understanding the company profile, organizational structure, product portfolio, customer segments, and operational workflow. This project also aims to bridge the gap between theoretical knowledge gained during academic studies and real-time industrial practices. Luft Tech Equipments focuses on supplying high-quality air filters and air handling solutions that meet industry standards. The company emphasizes reliability, efficiency, and customer satisfaction. Its products are designed to control dust, pollutants, and airborne particles, thereby ensuring a clean and safe working environment. These solutions are widely used in industries such as manufacturing, pharmaceuticals, food processing, textiles, and engineering units.

Keywords: *Employee Engagement, Organizational Productivity, Human Resource Practices, Job Satisfaction Employee Motivation, Work Environment*

A STUDY ON EFFECTIVENESS OF HRIS SOFTWARE ON EMPLOYEE PERFORMANCE IN WORKPLACE AT AQUASUB ENGINEERING

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ABSTRACT

This study focuses on the effectiveness of Human Resource Information System (HRIS) software on employee performance in the workplace at Aquasub Engineering. The research aims to analyze how HRIS contributes to improving employee efficiency, productivity, and overall organizational performance. The study uses a combination of primary and secondary data, including surveys and observations, to understand the role of HRIS in managing employee data, attendance, payroll, and performance evaluation. The findings reveal that HRIS software plays a significant role in reducing manual work, increasing accuracy, and enhancing communication within the organization. It also helps in better decision-making and improves employee satisfaction by providing transparency and easy access to information. However, certain challenges such as technical issues and lack of training were also identified. The study concludes that effective implementation of HRIS software positively impacts employee performance and organizational growth. It also suggests that proper training and system updates can further improve its efficiency in the workplace.

Keywords: *HRIS, Employee Performance, Payroll Management, Workplace Efficiency, Human Resource Management, Organizational Growth*

A STUDY OF AN EMPLOYEES LIFE CYCLE ON GAINUP INDUSTRIES BATLAGUNDU HIGHWAY, DINDIGUL

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ABSTRACT

This study examines the employee life cycle at Gain up Industries India Private Limited, focusing on key stages such as recruitment, on boarding, development, retention, and separation. The objective is to understand how human resource practices influence employee engagement, performance, and retention within the organization. The research uses a descriptive approach, collecting primary data through questionnaires and discussions with employees, along with secondary data from company records and literature. The findings indicate that effective on boarding, training, and employee engagement activities contribute positively to job satisfaction and productivity, while challenges such as communication gaps and limited career growth opportunities affect retention. The study concludes that a well-structured employee life cycle enhances organizational efficiency and recommends improving HR practices, feedback systems, and employee development initiatives for better outcomes.

Keywords: *Employee Cycle, Recruitment, On boarding, Training, Engagement, Performance, Retention, Job Satisfaction, HRM, Effectiveness, Career Growth, Experience.*

A STUDY ON EFFECTIVENESS OF PAYROLL PROCESS DYNERGIC INFRATECH LLP, CHENNAI

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ABSTRACT

This study explores the payroll process is a vital administrative function that ensures employees are compensated accurately and on time while maintaining compliance with statutory regulations. It involves systematic activities such as collecting employee data, calculating earnings and deductions, and determining net pay. The process also includes generating salary statements and ensuring secure salary disbursement. Additionally, payroll plays a key role in legal compliance, financial reporting, and organizational decision-making. With the adoption of automated systems integrated with Human Resource Management Systems (HRMS), payroll processing has become more efficient, accurate, and reliable.

Keywords: *Payroll Process, Employee Compensation, Earnings and Deductions, Net Salary, Statutory Compliance, Salary Disbursement, HRMS, Payroll Automation*

A STUDY ON EFFECTIVENESS OF PERFORMANCE APPRAISAL SYSTEM

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ABSTRACT

This internship project was carried out at JPR Aqua Farm, a small-scale enterprise engaged in aquaculture and related water-based farming activities. The company primarily focuses on fish farming, water resource management, and supplying quality fish products to local markets and customers. It caters to the growing demand for sustainable aquaculture practices and fresh aquatic products. The main objective of this internship was to gain practical exposure to the operations of an aquaculture-based organization and to understand the effectiveness of the performance appraisal system followed in the company. During the internship period, emphasis was placed on studying the organizational structure, operational activities, employee roles, and human resource practices, particularly the performance evaluation process. This project also aims to bridge the gap between theoretical knowledge acquired during the MBA program and real-time industry practices. Special focus was given to analyzing how performance appraisal systems influence employee productivity, motivation, and overall organizational performance. JPR Aqua Farm emphasizes efficient farm management, quality production, and effective workforce utilization. The findings of this project are expected to provide valuable insights into improving performance appraisal practices in small-scale aquaculture industries and enhancing overall organizational efficiency.

Keywords: *Performance Appraisal System, Employee Performance, Employee Motivation, Job Satisfaction, Performance Evaluation, Human Resource Management, Feedback System, Organizational Effectiveness, Employee Productivity, Performance Management*

A STUDY OF HEALTH, SAFTY AND WELFARE MEASURES IN WORK PLACE AT D.R TECH – DINDIGUL NEVEDHA KNITTS, TIRUPUR

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ABSTRACT

This study evaluates the health, safety, and welfare measures implemented at D.R Tech, focusing on their impact on employee well-being, productivity, and job satisfaction. It examines workplace safety policies, health facilities, sanitation, emergency preparedness, and welfare programs using data collected through surveys, employee feedback, and organizational records. The study also assesses employee awareness of safety practices and the role of management in maintaining a secure work environment. The findings indicate that effective implementation of health and safety measures reduces workplace hazards, enhances employee morale, and improves overall efficiency, while welfare initiatives contribute significantly to job satisfaction. The study concludes by recommending stronger policy enforcement, regular safety training, and continuous monitoring to ensure a safe and supportive workplace.

Keywords: *Workplace Health, Safety Measures, Employee Welfare, Occupational Safety, Workplace, Environment, Employee Satisfaction, Industrial Safety*

A STUDY ON ROLE OF HR IN EMPLOYEE PERFORMANCE IMPROVEMENT IN WORK PACE AT SREE VIDYA INDUSTRIES

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ABSTRACT

This study examines the role of Human Resource (HR) practices in improving employee performance and work pace at SreeVidya Industries. It focuses on key HR functions such as training, performance appraisal, and motivation. The research is based on primary data collected through questionnaires and secondary sources. The findings show that effective HR practices help enhance employee efficiency, productivity, and job satisfaction. Proper training and supportive work environment play a vital role in improving work pace. The study suggests that strong HR strategies can lead to better employee performance and organizational growth.

Keywords: HR Practices, Employee Performance, Work Pace, Training, Motivation

A STUDY ON FINANCIAL PERFORMANCE ANALYSIS IN WORK PLACE AT ANNA COOPERATIVE SPINNING MILLS, ANDIPATTI

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ABSTRACT

Financial performance analysis is a critical aspect of organizational management and strategic planning. It serves as a diagnostic tool that enables decision-makers to evaluate the efficiency and profitability of a company's operations. It serves as the vital "health check-up" of a business enterprise. It is a process of selecting, relating, and evaluating financial data statements to understand the company's operational efficiency and creditworthiness. For a capital-intensive industry like a spinning mill, monitoring financial health is essential to ensure the well-being of stakeholders, protect investor interests, and maintain a competitive edge in the global textile market. A strong financial position improves creditworthiness, facilitates expansion, and builds long-term institutional trust. The type of research adopted in this study is primarily Quantitative Research based on descriptive and analytical methods. The study heavily relies on Secondary Data collected from the audited annual reports, balance sheets, and profit and loss accounts of the company for a period of five consecutive years. This longitudinal approach allows for a comprehensive understanding of financial trends and operational shifts over time. Financial performance analysis focuses on assessing the company's ability to generate revenue relative to its expenses. In this study, various financial tools such as Ratio Analysis, Comparative Statement Analysis and Trend Analysis are used to identify patterns in income and expenditure. These tools help in pinpointing specific areas of financial strength and highlighting potential vulnerabilities in the mill's cost structure.

Keywords: *Ratio Analysis, Secondary Data Analysis, Profitability Assessment, Trend Analysis, Strategic Planning, Comparative Statement Analysis, Resource Allocation, Annual Financial Reports, Fiscal Policy Formulation.*

A STUDY ON A EFFECTIVENESS OF MOTIVATIONAL TOOLS ON EMPLOYEE PERFORMANCE THENI GURU KRISHNA TEXTILE PVT, THENI

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ABSTRACT

The success and sustainability of any organization significantly depend on the performance of its human resources. In the competitive textile industry, maintaining high levels of employee performance is vital for productivity, quality, and organizational growth. This study explores the effectiveness of motivational tools on employee performance at Guru Krishna Textile Pvt. Ltd., Theni, a medium-sized textile manufacturing company known for its commitment to workforce development and operational excellence. The primary objective of this research is to examine how various motivational strategies adopted by the organization influence employee attitudes, commitment, productivity, and overall performance outcomes. The study begins by contextualizing the role of motivation in organizational behavior. Motivation is defined as the internal and external forces that stimulate employees to take actions that lead to goal achievement. In a manufacturing environment like textiles, where repetitive tasks, tight production schedules, and quality expectations are the norm, motivation becomes a key determinant of employee morale and performance consistency.

Keywords: *Employee Motivation, Job Satisfaction, Incentives and Rewards, Organizational Productivity, Employee Engagement, Work Efficiency*

A STUDY ON RECRUITMENT AND TALENT ACQUISITION STRATEGIES DEVI AGROS

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ABSTRACT

This study examines the effectiveness of recruitment and talent acquisition practices at Devi Agros Pvt. Ltd. It focuses on hiring strategies, selection methods, and employee retention. The study evaluates strengths, challenges, and the role of modern tools like job portals, social media, and referrals. Using surveys and interviews, it analyzes recruitment efficiency, fairness, and alignment with organizational goals. The findings help improve HR practices and workforce quality.

Keywords: *Recruitment, Talent Acquisition, Hiring Strategies, Employee Selection, Workforce Quality, HR Practices, Recruitment Efficiency, Employee Retention, Organizational Performance, HR Management*

A STUDY ON EFFECTIVENESS OF TRAINING ON EMPLOYEE PERFORMANCE IN SUNSHINE SOLUTIONS, THENI

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ABSTRACT

This study focuses on analyzing the effectiveness of training programs on employee performance in an organization. Training plays an important role in improving employees' skills, knowledge, and overall work efficiency. The main objective of this study is to understand whether training programs help employees perform better in their jobs. The study is based on both primary and secondary data. Primary data is collected through questionnaires given to employees, while secondary data is collected from company records and other relevant sources. Simple analytical tools such as percentage analysis are used to interpret the data. The study examines the impact of training on employee performance, productivity, and job satisfaction. It also helps to understand employees' opinions about the training programs provided by the organization. Finally, the study provides useful suggestions to improve training programs so that employees can enhance their performance and contribute to the overall growth of the organization.

Keywords: *Training and Development, Employee Efficiency, Performance Improvement, Learning and Development, Employee Skills, Workplace Training, Organizational Effectiveness*

A STUDY ON EMPLOYER EMPLOYEE RELATIONSHIP MANAGEMENT (HR) - JENIS PRAJAA

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ABSTRACT

This study explores the current state of employer–employee relationship management at Jenis Prajaa, examining the factors that influence mutual trust, communication, and workplace harmony. Through a mixed-methods approach, combining surveys, interviews, and organizational case analysis, this research investigates the impact of leadership style, communication practices, HR policies, and conflict resolution mechanisms on the quality of employer–employee relationships. The purpose is to evaluate how effective relationship management contributes to employee satisfaction, engagement, and organizational performance, with a focus on grievance handling, transparency, recognition, and participation in decision-making within the workplace. The findings highlight key challenges such as communication gaps, lack of trust, and limited employee involvement, as well as opportunities for improvement through open communication channels, fair HR practices, participative management, and employee welfare initiatives. The study provides recommendations for strengthening employer–employee relationships, enhancing job satisfaction, and fostering a positive and productive work environment.

Keywords: *Employer–employee relationship, HR practices, communication, employee engagement, job satisfaction, conflict management, organizational culture.*

A STUDY ON IMPACT OF TEAM WORK AND COLLABORATION AT ANNA COOPERATIVE SPINNING MILLS, AUNDIPATTI

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ABSTRACT

The project study has been conducted in “ANNA CO-OPERATIVE SPINNING MILLS LIMITED ” regarding A study on Impact of team work and collaboration. Teamwork and collaboration are fundamental elements of modern organizations, educational institutions, and social systems. In an increasingly interconnected and competitive world, the ability of individuals to work together effectively has become a key determinant of success. Teamwork refers to the combined efforts of individuals working toward a common goal, while collaboration emphasizes shared responsibility, open communication, and collective problem-solving. Together, these concepts shape productivity, innovation, employee satisfaction, and organizational growth. The importance of teamwork and collaboration has grown significantly due to globalization, technological advancement, and the complexity of modern challenges. No single individual possesses all the skills or knowledge required to address multifaceted problems. Effective teamwork also improves communication within organizations. Collaboration requires open, honest, and respectful communication among team members. Through regular interaction, individuals develop better listening and interpersonal skills.

Keywords: *Interpersonal Dynamics, Crossed-Functional Collaboration, Shared Responsibility, Collective Efficiency, Organizational Performance.*

A STUDY ON THE IMPACT OF EMPLOYEE WELFARE FACILITIES ON JOB SATISFACTION AT ABSERVE TECH, MADURAI

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ABSTRACT

This study analyzes the impact of employee welfare facilities on job satisfaction at Abserve Tech Private Limited, Madurai. It focuses on welfare measures such as health benefits, flexible working hours, work-from-home options, training programs, and workplace environment, and their influence on employee satisfaction, motivation, and performance. Using a descriptive research approach, primary data was collected through structured questionnaires, supported by secondary sources like company records and journals. The findings reveal that welfare facilities, particularly health insurance, flexible work arrangements, and training opportunities, have a positive effect on job satisfaction and productivity, while issues like limited career growth and communication gaps can negatively impact morale. The study concludes that effective welfare practices enhance employee satisfaction, retention, and overall organizational performance, and recommends improving welfare programs, communication, and career development opportunities for long-term success.

Keywords: *Employee Welfare, Job Satisfaction, Work-Life Balance, HR Practices, Employee Engagement, IT Industry, Workplace Environment, Productivity, Career Growth, Organizational Performance*

A STUDY ON COMPENSATION STRUCTURE AND SATISFACTION LEVEL OF EMPLOYEES IN RICH PHYTOCARE PRIVATE LTD, BODI

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ABSTRACT

Compensation structure is a vital element in human resource management that directly influences employee satisfaction, motivation, and organizational performance. This study aims to examine the relationship between compensation structure and the satisfaction level of employees in an organization. It focuses on various components of compensation such as salary, wages, incentives, bonuses, and other benefits, and evaluates how these factors contribute to overall job satisfaction. The findings indicate that a fair and well-designed compensation structure has a significant positive impact on employee satisfaction. It also reveals that employees are more motivated and committed when compensation policies are transparent and performance-based. However, the study also identifies certain areas of improvement, such as the need for better communication of compensation policies and enhancement of incentive schemes. The study concludes that organizations should regularly review and update their compensation systems to meet employee expectations and remain competitive in the market.

Keywords: *Compensation Structure, Employee Satisfaction, Salary and Wages, Incentives and Benefits, Job Satisfaction, Motivation, Organizational Performance, Human Resource Management*

A STUDY ON WORKPLACE WELLNESS AND CULTURE IN CIBI KRISHNA TEXTILES PVT LTD, THENI

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ABSTRACT

This internship project was carried out at Cibi Krishna Textiles Pvt. Ltd., a textile manufacturing company engaged in producing quality fabric and textile products. The study focuses on analyzing workplace wellness practices and the existing organizational culture within the company. The primary objective of this study is to understand how workplace wellness initiatives and organizational culture influence employee satisfaction, motivation, and overall performance. The research also aims to identify the effectiveness of current practices related to employee health, safety, work environment, and interpersonal relationships within the organization. During the internship period, emphasis was given to observing company operations, interacting with employees, and understanding departmental functions. This study bridges the gap between theoretical concepts of human resource management and their practical application in an industrial setting. Workplace wellness practices such as safety measures, proper working conditions, and employee support systems contribute to enhancing productivity and reducing stress levels. The findings of the study indicate that a positive organizational culture combined with effective wellness practices leads to higher employee satisfaction, improved performance, and better overall organizational outcomes.

Keywords: *Workplace Wellness, Organizational Culture, Employee Satisfaction, Employee Productivity, Work Environment, Employee Well-being, Organizational Performance*

A STUDY ON EMPLOYEE RELATIONS AND GRIEVANCE HANDLING MECHANISM AT VINAYAGA TEX, COIMBATORE

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ABSTRACT

This study examines employee relations and the grievance handling mechanism at Vinayaga Tex, a textile and garment manufacturing organization located in Coimbatore. The study focuses on understanding the relationship between employees and management, communication practices, workplace environment, and the effectiveness of grievance redressal systems in resolving employee issues. The research adopts a descriptive approach, collecting primary data through structured questionnaires from employees across various departments, along with secondary data from company records, journals, and academic sources. The findings indicate that effective communication, supportive supervision, and fair grievance handling procedures contribute positively to employee satisfaction and workplace harmony, while issues such as communication gaps and delays in grievance resolution may affect employee morale. It is recommended that the organization strengthen its grievance redressal system, improve communication channels, and ensure timely resolution of employee concerns to achieve long-term success.

Keywords: *Employee Relations, Grievance Handling, Workplace Communication, HR Practices, Employee Satisfaction, Textile Industry, Conflict Management, Organizational Performance, Workplace Environment, Employee Engagement*

TO STUDY THE OVERALL FINANCIAL PERFORMANCE OF AAVIN CO – OPERATIVE LIMITED

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ABSTRACT

This project titled “A Study on Financial Performance Analysis of Aavin Co – operative limited” focuses on analyzing the financial health and operational efficiency of Aavin (Tamil Nadu Co-operative Milk Producers’ Federation Limited). The main objective of the study is to evaluate the company’s profitability, liquidity, solvency, and overall financial performance over a selected period. The study is based on secondary data collected from annual reports, financial statements, and other published records of the company. Various financial tools and techniques such as ratio analysis, comparative statements, and trend analysis have been used to interpret the financial position of the organization. The analysis helps in identifying the financial strengths and weaknesses of Aavin and provides useful insights for improving financial planning and decision-making. It also evaluates the company’s ability to meet its short-term and long-term financial obligations and assesses how efficiently it manages its resources. The findings of the study offer meaningful suggestions to enhance the financial performance and ensure the long-term sustainability of the company. The data used in this research has been carefully organized and analysed to ensure accuracy and reliability of the results.

Keywords: *Financial Performance, Profitability, Liquidity, Solvency, Ratio Analysis Comparative Analysis, Trend Analysis, Financial Statements.*

A STUDY ON EMPLOYEE SATISFACTION AT GAANAPATHY TEXTILES

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ABSTRACT

This study examines employee satisfaction at Gaanapathy Textiles, a textile manufacturing company in Tamil Nadu, focusing on factors such as working conditions, compensation, job security, management practices, communication, and career development. Using a descriptive research approach, primary data was collected through structured questionnaires along with secondary data from company records and academic sources. The findings reveal that supportive supervision, a safe work environment, fair compensation, and welfare measures positively influence employee satisfaction, while limited growth opportunities and communication gaps can reduce morale. The study concludes that maintaining high employee satisfaction is crucial for improving productivity, reducing turnover, and enhancing organizational performance, and recommends strengthening HR practices, communication, and career development opportunities for long-term success.

Keywords: *Employee Satisfaction, Workplace Environment, Compensation, Job Security, HR Practices, Employee Engagement, Productivity, Textile Industry, Organizational Performance, Career Growth*

A STUDY ON LABOUR WELFARE MEASURES AND ITS IMPACT ON EMPLOYEE EFFICIENCY IN WORKPLACE AT VAJRAMAALA AGRO FOODS

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ABSTRACT

This study focuses on analysing the labour welfare measures and their impact on employee efficiency in Vajramaala Agro Foods Company. Labour welfare plays a crucial role in improving the overall well-being, motivation, and productivity of employees within an organization. The objective of this project is to examine the various welfare facilities provided by the company and evaluate how these measures influence employee performance and efficiency. The study covers key welfare aspects such as working conditions, health and safety, canteen facilities, rest intervals, medical support, and other employee benefits. Primary data was collected through questionnaires distributed to employees, along with informal discussions to understand their satisfaction levels. Secondary data was gathered from company records, reports, and relevant literature. The findings of the study indicate that effective labour welfare measures have a positive impact on employee efficiency, job satisfaction, and morale. Employees who are provided with better welfare facilities tend to perform more efficiently and show higher commitment towards the organization contribute significantly to organizational growth and productivity. Recommendations have been provided to strengthen existing welfare practices and improve employee efficiency further.

Keywords: *Labour Welfare Measures, Employee Efficiency, Job Satisfaction, Workplace Safety, Employee Motivation, Organizational Performance*

A STUDY ON THE DATA ANALYTICS AND BUSINESS INTELLIGENCE

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ABSTRACT

Data Analytics and Business Intelligence (BI) play a crucial role in modern organizations by transforming raw data into meaningful insights for effective decision-making. In today's data-driven world, businesses generate vast amounts of data from various sources such as transactions, customer interactions, social media, and operational processes. Data analytics involves the systematic computational analysis of this data to identify patterns, trends, and relationships. Business Intelligence, on the other hand, focuses on using tools, technologies, and strategies to present analyzed data in a user-friendly manner through dashboards, reports, and visualizations. Together, data analytics and BI enable organizations to improve performance, optimize operations, enhance customer experience, and gain a competitive advantage. The integration of advanced techniques such as predictive analytics, machine learning, and artificial intelligence has further strengthened the capabilities of BI systems. These technologies help organizations forecast future trends, identify risks, and make proactive decisions. Moreover, real-time analytics allows businesses to respond quickly to changing market conditions. Despite its advantages, implementing data analytics and BI comes with challenges such as data quality issues, privacy concerns, and the need for skilled professionals. However, with proper data governance and technological infrastructure, organizations can overcome these challenges and fully leverage the potential of data.

Keywords: *Data Analytics and Business Intelligence are essential components for strategic planning and sustainable growth in modern enterprises, enabling informed decision-making and driving innovation*

IMPACT OF ARTIFICIAL INTELLIGENCE ON HUMAN RESOURCE MANAGEMENT

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ABSTRACT

Artificial Intelligence (AI) has emerged as a transformative force in Human Resource Management (HRM), redefining traditional HR practices and enhancing organizational efficiency. By leveraging technologies such as machine learning, natural language processing, and predictive analytics, organizations are able to automate routine HR functions including recruitment, screening, onboarding, and employee engagement. AI-driven tools enable data-driven decision-making by providing real-time insights into employee performance, talent acquisition, and workforce planning, thereby improving productivity and reducing operational costs. This examines the multifaceted impact of AI on HRM functions, including talent acquisition, training and development, performance management, and employee retention. It also explores how AI enhances decision-making by identifying patterns, predicting employee behavior, and supporting strategic HR planning. Furthermore, AI-powered systems such as chatbots and virtual assistants contribute to improved employee experience and communication within organizations. While AI offers significant advantages, it also presents challenges such as ethical concerns, data privacy issues, workforce displacement, and algorithmic bias. This highlights both the opportunities and limitations in HRM.

Keywords: Artificial Intelligence, Human Resource Management, Recruitment, Employee Engagement, Predictive Analytics, Automation, Talent Management, Data-driven decision making, Ethical challenges.

A STUDY ON ROLE OF SALES ORDER PROCESSING

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ABSTRACT

The project entitle SALES ORDER PROCESSING has been designed and developed for any Electrical and Electronics Enterprises or any other. The main aim of this project is to computerization of daily activities in the enterprise. It is n database system for creating as elective information, for subsequent analysis manipulation and application. The project contains several modules to record the details about the product, customer details and bill details the about the goods which the customer has purchased from the enterprise. And it maintains the reports about the products, customers, orders and bills. The project is very useful to sale the goods in any enterprise.

Keywords: Customer Order, Order Entry, Sales Order, Credit Check, Inventory Check, Packing Slip, Invoice, Billing, Payment Processing, Order Tracking, Return | Refund, Delivery Note, ERP System.

A STUDY ON ROLE OF HR IN EMPLOYEE PERFORMANCE IMPROVEMENT IN THE IMPACT OF GENERATIVE AI ON BUSINESS DECISION MAKING

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ABSTRACT

In the rapidly evolving digital landscape, Generative Artificial Intelligence (GenAI) has emerged as a disruptive force in corporate strategy. This paper examines the shift from traditional analytical models to generative models in business decision-making. Unlike predictive AI, which forecasts based on existing patterns, GenAI assists leaders by synthesizing complex data into actionable insights, automating report generation, and simulating various business scenarios. The research highlights how organizations can leverage GenAI to reduce cognitive bias and enhance the speed of strategic planning. Furthermore, it addresses the critical balance between AI-driven automation and human intuition. Through various case studies, this paper concludes that integrating GenAI into the decision-making pipeline is no longer an option but a necessity for maintaining a competitive advantage in the 2026 global market.

Keywords: *Generative AI, Business Decision-Making, Strategic Planning, Data Analytics, Corporate Innovation.*

IMPACT OF AI ON BUSINESS OPERATIONS AND DECISION MAKING

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ABSTRACT

A

rtificial Intelligence (AI) has emerged as a transformative force reshaping the way businesses operate and make decisions. By leveraging machine learning, natural language processing, and predictive analytics, organizations are able to automate routine tasks, optimize resource allocation, and enhance customer engagement. AI-driven tools provide real-time insights, enabling data-informed strategies that improve efficiency, reduce costs, and foster innovation. This paper examines the multifaceted impact of AI on business operations, including process automation, supply chain optimization, and personalized marketing. It also explores how AI enhances decision-making by identifying patterns, forecasting trends, and supporting strategic planning. While AI offers immense opportunities, challenges such as ethical considerations, data privacy, workforce adaptation, and algorithmic bias remain critical. The study highlights both the potential and limitations of AI, emphasizing its role as a catalyst for competitive advantage in the digital economy.

Keywords: *Artificial Intelligence, Business operations, Decision-making, Machine learning, Predictive analytics, Automation, Data-driven, strategy Supply chain optimization, Customer engagement, Ethical challenges.*

A STUDY ON THE ROLE OF SUPPLY CHAIN MANAGEMENT IN IMPROVING ORGANIZATIONAL PERFORMANCE

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ABSTRACT

This study explores the role of Supply Chain Management (SCM) in enhancing organizational performance and operational efficiency, with special reference to a selected organization. It focuses on the integration of key supply chain functions such as procurement, production planning, inventory control, logistics, and distribution management. The research aims to analyze how effective supply chain strategies contribute to improved workflow, cost optimization, and customer satisfaction in a competitive business environment. The study is based on both primary and secondary data. Primary data were collected through structured questionnaires administered to employees and managerial staff, while secondary data were obtained from journals, company reports, and relevant academic sources. The analysis emphasizes the importance of coordination among supply chain partners and the adoption of modern technologies in streamlining operations. The findings indicate that efficient supply chain practices significantly improve productivity, reduce operational delays, and enhance service quality. Effective inventory management, strong supplier relationships, and the use of digital tools such as ERP systems play a vital role in strengthening supply chain performance. The study concludes that organizations adopting advanced SCM practices are better positioned to achieve sustainable growth, competitive advantage, and long-term success.

Keywords: *Supply Chain Management, Logistics, Inventory Control, Procurement, Operational Efficiency, ERP Systems, Customer Satisfaction*

A STUDY ON FINANCIAL INNOVATION

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ABSTRACT

Financial innovation refers to the creation and development of new financial products, services, technologies, or processes that improve the efficiency and effectiveness of financial systems. It includes innovations such as digital payments, online banking, mobile wallets, block chain technology, and new investment instruments. The main objective of financial innovation is to reduce costs, increase accessibility, manage risks, and enhance customer convenience. It helps financial institutions provide better services and supports economic growth by improving capital allocation and expanding financial inclusion. Financial innovation has been driven largely by technological advancements, especially in the field of FinTech, which combines finance and information technology. These innovations have transformed traditional banking systems and created new opportunities for businesses and individuals. Financial innovation also brings challenges such as increased complexity, regulatory issues, and potential financial risks.

Keywords: *Financial Innovation, Fin Tech, Digital Payments, Mobile Banking, Online Banking, Financial Inculsion, Risk Management, Financial Markets, Innovation in Banking*

A STUDY ON HR PRACTICES TOWARDS ORGANIZATIONAL PRODUCTIVITY IN RNL MILLS

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ABSTRACT

Human Resource (HR) practices play a vital role in improving organizational productivity by effectively managing employee performance and organizational resources. In the modern business environment, organizations recognize that human capital is one of the most valuable assets for achieving competitive advantage. This study focuses on analyzing the impact of HR practices on organizational productivity with special reference to RNL Mills. The study examines key HR practices such as recruitment and selection, training and development, performance appraisal, compensation and benefits, employee engagement, and work environment at RNL Mills. These practices are evaluated to understand how they influence employee motivation, job satisfaction, and efficiency, which directly contribute to productivity. A descriptive research design is adopted for the study. Primary data is collected through structured questionnaires distributed among employees of RNL Mills, while secondary data is gathered from books, journals, and online sources to support the research.

Keywords: *HR practices, Productivity, compensation, Human Capital, Employee performance, Training and development*

A STUDY ON EMPLOYEE RETENTION STRATEGIES IN KRISHNAVENI CARBON PRODUCTS PVT LTD

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ABSTRACT

Employee retention has become a critical concern for organizations seeking to maintain productivity, reduce recruitment costs, and sustain competitive advantage. High employee turnover can disrupt workflow, reduce team morale, and increase operational expenses. Therefore, implementing effective employee retention strategies is essential for long-term organizational success. This study explores the various factors influencing employee retention and identifies key strategies that organizations can adopt to retain skilled and experienced employees. The research highlights that job satisfaction, career development opportunities, competitive compensation, and a positive work environment are among the most significant determinants of employee retention. Organizations that provide regular training programs, clear career progression paths, and recognition for employee performance tend to experience higher retention rates. Additionally, supportive leadership, transparent communication, and employee engagement initiatives contribute to building trust and loyalty among employees.

Keywords: *Employee Retention, Employee strategies, Career Development, Training Programs*

A STUDY ON EMPLOYEE SAFETY AND SECURITY MEASURES IN SRI JAYABHARATHI GINNING FACTORY

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ABSTRACT

The project study has been conducted in “**SRI JAYABHARATH GINNING FACTORY**” regarding A study on Employee Safety and Security. Employee safety and security is critical aspects of organizational management. They ensure the well-being of employees and protect company assets, information, and reputation. A safe and secure work place improves productivity, morale, and trust. It determined by various factors including salary and benefits, work environment, job security, career growth opportunities management support, and work-life balance. This research aims to analyze how these elements impact employee motivation and performance, ultimately contributing to organizational growth. This type of research adopted in this study is Qualitative and Quantitative Research. A questionnaire was used to collect primary data from employees at different levels. Employee safety focuses on protecting workers from accidents, injuries, and health risks. Organizations must follow safety laws, provide proper training, and maintain a hazard-free environment.

Keywords: *Safety policies, providing resources, ensuring compliance, safety rules, hazards, cooperate emergencies, Employee safety security.*

A STUDY ON INDUSTRIAL RELATIONS AND COMPLIANCE OF LABOUR LEGISLATION AT SREE VAISHNAVI INDUSTRIES, MADURAI

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ABSTRACT

This study examines the impact of industrial relations and compliance with labour legislation on organizational performance. It has been observed that many organizations struggle to maintain effective employer–employee relationships and often fail to strictly adhere to labour laws. This results in workplace conflicts, employee dissatisfaction, and decreased productivity. The study emphasizes the importance of fostering healthy industrial relations through effective communication, proper grievance handling mechanisms, and active employee participation in organizational activities. It also highlights the critical role of labour legislation in ensuring employee welfare, workplace safety, fair wages, and job security. The research is based on both primary and secondary data. Primary data were collected from employees through structured questionnaires and personal interactions, while secondary data were obtained from company records, books, and academic journals. The findings reveal that strong industrial relations practices and strict compliance with labour laws significantly enhance employee satisfaction, improve productivity, and contribute to overall organizational stability. The study concludes that maintaining positive industrial relations and ensuring adherence to labour legislation are essential for achieving long-term organizational success. It is recommended that organizations adopt effective human resource practices and strictly comply with labour laws to enhance employee performance and sustain long-term growth.

Keywords: *Industrial Relations, Labour Legislation, Employee Satisfaction, Productivity, Organizational Performance.*

A STUDY ON WORK LIFE BALANCE KANNAN DEVAN HILLS PLANTATION TEA FACTORY

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ABSTRACT

The “Organizational Study on the Working of the Tea Industry in Kannan Devan Hills Plantation Tea Factory, Munnar .” This study examines the structure, operations, and management practices of the organization, highlighting its role in the tea industry of Kerala. The study explores various functional departments such as production, human resources, quality control, finance, and marketing. It also analyzes the workflow involved in tea processing, from plucking of tea leaves to final packaging. Special emphasis is given to the company’s quality standards and modern techniques adopted in tea manufacturing. In addition, the study highlights the social and economic contributions of the organization, including employment generation and support to the local community. The company’s focus on environmental sustainability, including eco-friendly cultivation and resource management practices, is also discussed.

Keywords: *Recruitment, Talent Acquisition, Hiring Strategies, Employee Selection, Workforce Quality, HR Practices, Recruitment Efficiency, Employee Retention, Organizational Performance, HR Management*

THE EFFECT OF COMMUNICATION ON PRODUCTIVITY AND PERFORMANCE OF EMPLOYEES

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ABSTRACT

Effective communication plays a crucial role in enhancing the productivity and performance of employees within an organization. This study examines how clear, timely, and transparent communication influences employee efficiency, job satisfaction, and overall organizational success. Communication acts as a bridge between management and employees, ensuring that goals, expectations, and feedback are properly conveyed and understood. The research highlights that organizations with strong communication systems experience improved coordination, reduced conflicts, and higher employee engagement. Both formal communication (meetings, reports, emails) and informal communication (interpersonal interactions) contribute significantly to building trust and teamwork among employees. Additionally, the integration of modern communication technologies has further improved the speed and accuracy of information sharing. The study concludes that effective communication not only boosts individual employee performance but also enhances team collaboration and organizational productivity. Poor communication, on the other hand, can lead to misunderstandings, errors, and decreased efficiency. Therefore, organizations must prioritize developing strong communication strategies and skills to achieve sustainable growth and competitive advantage.

Keywords: *Communication, Employee Productivity, Employee Performance, Organizational Communication, Workplace Efficiency, Employee Engagement, Team Collaboration, Job Satisfaction, Information Sharing, Organizational Success*

“INTEGRATIVE APPROACHES OF ARTIFICIAL INTELLIGENCE, MACHINE LEARNING, AND DEEP LEARNING FOR ADVANCED BUSINESS ANALYTICS AND DECISION MAKING”

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ABSTRACT

This study examines integrative approaches that combine Artificial Intelligence (AI), Machine Learning (ML), and Deep Learning (DL) to strengthen advanced business analytics and decision-making. As organizations increasingly operate in data-rich and highly dynamic environments, conventional analytical methods are often insufficient for capturing complex patterns, forecasting outcomes, and supporting timely strategic responses. AI provides a broader intelligent framework for automation and reasoning, while ML enables systems to learn from data and improve predictive performance. DL extends these capabilities by extracting high-level representations from large, complex, and unstructured datasets, making it especially valuable for sophisticated analytics tasks. Recent research also shows that business analytics supports strategic planning and decision outcomes when it is aligned with organizational affordances, governance, and decision processes. In practice, integrated AI-ML-DL frameworks can improve customer analytics, demand forecasting, fraud detection, risk evaluation, and performance prediction across business functions. However, effective implementation depends on addressing challenges related to data quality, transparency, interpretability, ethics, and organizational readiness, since explainability and trust remain essential for responsible decision-making. Overall, the convergence of AI, ML, and DL offers a powerful foundation for transforming business analytics into a more adaptive, predictive, and strategically useful decision-support capability.

Keywords: *Artificial Intelligence; Machine Learning; Deep Learning; Business Analytics; Decision Making; Predictive Analytics; Data-Driven Decision Support; Explainable AI; Strategic Planning; Intelligent Systems.*

“INTEGRATING IOT AND BLOCKCHAIN FOR SUSTAINABLE WASTE MANAGEMENT IN COLD CHAIN FOOD SUPPLY CHAINS: ENHANCING EFFICIENCY AND ACCOUNTABILITY”

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ABSTRACT

The increasing demand for perishable food products has made cold chain supply systems more critical, while also raising concerns about food waste, inefficiencies, and lack of transparency. This study explores the integration of the **Internet of Things (IoT)** and **blockchain technology** to promote sustainable waste management in cold chain food supply chains. IoT-enabled sensors are used to monitor real-time conditions such as temperature, humidity, and storage environments, ensuring product quality throughout transportation and storage. Meanwhile, blockchain technology provides a decentralized and tamper-proof ledger that enhances traceability, accountability, and trust among stakeholders. The integration of these technologies helps in early detection of spoilage risks, reduces data manipulation, and improves decision-making through accurate and real-time information. This research highlights how combining IoT and blockchain can significantly reduce food wastage, enhance operational efficiency, and ensure regulatory compliance. Furthermore, the study examines challenges such as high implementation costs, technological complexity, and data integration issues. The findings suggest that adopting this integrated approach can lead to more sustainable, transparent, and efficient cold chain systems, benefiting both businesses and the environment.

Keywords: *Internet of Things (IoT); Blockchain Technology; Cold Chain Supply Chain; Sustainable Waste Management; Food Waste Reduction; Supply Chain Transparency; Real-Time Monitoring; Traceability Smart Logistics*

ENHANCING SUPPLY CHAIN EFFICIENCY THROUGH DATA-DRIVEN DECISION MAKING

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ABSTRACT

In the era of globalization and rapid technological advancement, supply chain management has evolved into a highly complex and data-intensive function. Organizations are increasingly shifting from traditional, experience-based decision-making approaches to data-driven decision-making (DDDM) to enhance efficiency, responsiveness, and competitiveness. This study explores the role of data-driven decision-making in improving supply chain efficiency by leveraging advanced technologies such as big data analytics, artificial intelligence (AI), machine learning (ML), and the Internet of Things (IoT). The primary focus of this research is to examine how data-driven strategies contribute to optimizing various supply chain functions, including demand forecasting, inventory management, procurement, transportation, and distribution. By utilizing real-time data and predictive analytics, organizations can gain actionable insights that enable proactive decision-making, reduce uncertainties, and improve operational performance. The integration of digital technologies allows firms to monitor supply chain activities continuously, identify potential disruptions, and implement corrective measures in a timely manner. This paper adopts a qualitative research approach based on an extensive review of existing literature, industry reports, and case studies related to data-driven supply chains. The study highlights the importance of accurate and timely data in enhancing decision quality and operational efficiency. It further emphasizes that organizations adopting data-driven approaches experience significant improvements in cost reduction, service levels, and overall supply chain agility. Despite its numerous benefits, the implementation of data-driven decision-making in supply chains is not without challenges. Issues such as data quality, integration complexities, high implementation costs, data security concerns, and lack of skilled professionals can hinder successful adoption. This study discusses these challenges and suggests strategies to overcome them, including investment in data governance, employee training, and robust technological infrastructure. The findings of this research indicate that data-driven decision-making serves as a critical enabler for building resilient and intelligent supply chains. Organizations that effectively leverage data analytics are better positioned to respond to market fluctuations, enhance customer satisfaction, and achieve sustainable competitive advantage. The study concludes by recommending that businesses adopt a

structured data-driven framework to fully realize the potential of digital transformation in supply chain management.

Keywords: *Supply Chain Management; Data-Driven Decision Making (DDDM); Big Data Analytics; Artificial Intelligence (AI); Machine Learning (ML); Internet of Things (IoT); Supply Chain Efficiency; Predictive Analytics; Digital Transformation*

MASTER OF COMPUTER APPLICATION

THE ROLE OF GENERATIVE AI IN PERSONALIZED LEARNING FOR HIGHER EDUCATION

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ABSTRACT

Generative Artificial Intelligence (AI) is transforming higher education by enabling highly personalized learning experiences tailored to individual student needs. Unlike traditional one-size-fits-all instructional models, generative AI systems analyze learner data, preferences, performance patterns, and engagement levels to dynamically generate customized study materials, practice questions, feedback, and interactive simulations. In higher education, generative AI supports adaptive learning pathways, automated content creation, intelligent tutoring systems, and real-time assessment feedback. It enhances student engagement by offering context-aware explanations, multilingual support, and personalized academic assistance across disciplines. Additionally, AI-powered tools assist educators by automating administrative tasks, generating course content, and identifying learning gaps through predictive analytics. However, the integration of generative AI also raises critical challenges, including data privacy concerns, algorithmic bias, academic integrity risks, and the need for ethical governance frameworks. Institutions must establish responsible AI policies, ensure transparency, and provide digital literacy training to maximize benefits while minimizing risks. Overall, generative AI has the potential to revolutionize personalized learning in higher education by fostering inclusivity, improving learning outcomes, and supporting scalable, student-centered education models. Its strategic and ethical implementation will determine its long-term impact on the future of academic learning.

TRUST TOKEN BANKING SYSTEM – MULTI - LEVEL TRANSACTION AUTHORIZATION PLATFORM

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ABSTRACT

The Trust Token Banking System is a secure digital banking platform designed to enhance transaction safety through multi-level authorization and token-based verification. In today's online banking environment, financial fraud, identity theft, and unauthorized transactions are major challenges. This project proposes a smart security framework that ensures every transaction is verified at multiple levels before approval. The system uses trust tokens (unique, time-based digital authentication codes) generated dynamically for each transaction. When a user initiates a transaction, the system verifies identity through multiple layers such as password authentication, OTP verification, biometric validation, and role-based authorization. For high-value transactions, additional approvals from higher authorities (such as bank managers or secondary account holders) are required. This multi-level verification process reduces the risk of fraud and ensures secure fund transfers.

SCHEME CONNECT PORTAL: ONE STOP FOR ALL GOVERNMENT SCHEME

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ABSTRACT

This project introduces a centralized platform designed to simplify the discovery, application, and tracking of various schemes for diverse user groups. The system is structured around two core interfaces-Admin and User-while integrating a hybrid customer support model. The Admin module provides secure access for managing the entire scheme lifecycle, including adding, editing, approving, and deleting entries. It also features robust analytics and monitoring tools to evaluate user engagement and operational efficiency. Admins are empowered to broadcast critical updates through notifications and oversee the resolution of user grievances. The interface allows users to apply for schemes effortlessly and monitor their application status in real-time. To enhance the user experience, an AI-powered chatbot provides immediate assistance for frequently asked questions and routine tasks. For more nuanced or technical issues, the system facilitates a seamless escalation path to human support agents. By automating administrative tasks and streamlining user interactions, the platform significantly reduces the complexity of navigating public and private schemes.

BANKING ATM FACIA RECOGNIZATION SOFTWARE USING TNIKER

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ABSTRACT

The AI Powered personalized learning and exam performance predictor is an innovative platform designed to enhance student learning through personalized and data driven insights. By leveraging AI, this system offers a comprehensive suite of features aimed at improving academic performance. Upon registration and login, students can access their tailored study plans based on their individual needs and strengths. The system uses advanced algorithms to predict exam scores, providing a clear indication of future performance and area for improvement. Additionally, automated assessments and quizzes allow students to measure their knowledge in real-time, while AI-generated note summarization helps them absorb key concepts efficiently. The platform also includes automated answer evaluation, giving students instant feedback on practice questions, enabling them to understand mistakes and refine their approach.

TRAVEL EMERGENCY CASH NETWORK

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ABSTRACT

This project presents a secure, location-based peer-to-peer platform designed to facilitate the seamless exchange of physical cash for digital payments. The system addresses the gap between digital liquidity and physical currency by connecting " Seekers " and " Givers " in real-time. To ensure a trustworthy environment, the application features a robust user registration process involving email verification and mandatory profile details, including UPI IDs and photo identification. Seekers can initiate requests by specifying the desired amount and location radius, while Givers can toggle their availability and accept nearby requests via an interactive mapinterface. Upon acceptance, the system generates a dummy UPI QR code to streamline the digital transaction before users meet at a designated location for the physical exchange. The platform maintains a detailed transaction history and includes an administrative panel for user management, monitoring, and dispute resolution. Developed using the Django framework with HTML templates, the application leverages Leaflet and OpenRoute maps for precise geographical services. By combining secure backend logic with real-time mapping, this project ensures transparency, security, and scalability in decentralized financial interactions.

AI-POWERED SMART HEALTH CARE MONITORING AND EARLY DISEASE PREDICTION SYSTEM

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ABSTRACT

The AI Powered Smart Healthcare Monitoring and Early Disease Prediction System is designed to improve early diagnosis and patient care using machine learning techniques. The system collects real-time biomedical data such as symptoms and health parameters from users and processes it through data preprocessing and analysis. It utilizes the Random Forest algorithm to predict the type of disease accurately by analyzing patterns and relationships within the dataset. The system also performs Exploratory Data Analysis (EDA) to understand data trends and improve model performance. By splitting the dataset into training and testing sets, the model is trained and evaluated effectively. The proposed system helps in providing fast, reliable, and accurate disease predictions, which can assist doctors and patients in making better healthcare decisions. This system contributes to improving early diagnosis, reducing medical risks, and enhancing healthcare efficiency.

LIVE STOCK PRICE PREDICTION

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ABSTRACT

This project focuses on the development and implementation of a sophisticated stock price prediction system designed to navigate the complexities of financial time series data. By leveraging three distinct stock market datasets in .csv format, the study emphasizes rigorous data preprocessing, including cleaning and normalization, to ensure high-quality inputs for the analytical models. The core methodology integrates advanced machine learning and deep learning techniques, specifically employing regression-based frameworks such as Support Vector

Machines (SVM) and Linear Regression to model market trends. While the primary objective is the accurate prediction of future stock values, the research also explores the integration of these frameworks to enhance overall predictive stability and performance. To provide a comprehensive assessment of the systems efficacy, the models are rigorously evaluated using a suite of industry-standard performance metrics. These include Accuracy, Mean Squared Error (MSE), Mean Absolute Error (MAE), and Root Mean Squared Error (RMSE). The resulting system aims to offer a robust computational approach to understanding market volatility and providing data-driven insights into stock price movements.

AI-POWERED FINANCIAL FRAUD DETECTION USING GRAPH NEURAL NETWORKS

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ABSTRACT

Artificial Intelligence (AI) enables machines to perform tasks that require human-like intelligence, including the prediction and detection of anomalies. The GRAPH Neural Networks (GNNs) can be successfully used in mobile payment systems to model user- user, device-user, merchant-user, and transaction relationships and detect fraud based on the pattern of relationships. Additionally, synthetic fraud examples produced by SMOTE-GAN seem realistic and balance the PaySim data set, and they improve the acquisition of rare patterns of fraud. Furthermore, Meta-Learning of Feature Selection is a dynamic feature selection model that selects the most predictive features, adapting to the evolving fraud patterns as well as removing noise. Finally, Heterogeneous Graph Neural Networks (HGNNs) learn both local and global patterns of many entities, and this is because they capture the intricate interactions between them. The presented method AI-GNN framework that offers mobile payment fraud detection based on adaptive, heterogeneous, and real-time risks.

ABOUT THE INSTITUTION

Bharath Niketan Engineering College (BNEC) is run by Nehru Rural Development (NRD) Educational Trust established by (Late) Shri. S.V. Ramani Iyer in 1998 with an objective to impart technical education to the rural youth and to promote welfare of the rural community. The college is managed by Shri. S. Mohan, Managing Chairman, a leading Industrialist and a philanthropist with a passion for developing the youth.

The college is located in a picturesque and scenic environment flanked by the Western Ghats. It is situated near Aundipatti, (Madurai- Cochin national highway) in Theni district, Tamil Nadu, India.

The college offers Eight UG courses (Agri, AI & DS, Civil, CSE, ECE, EEE, IT, MECH) and five PG courses (M.E- Industrial Safety Engg, M.E - Software Engg, M.E - Communication Systems, MBA and MCA). All the courses are approved by AICTE, New Delhi and affiliated with Anna University, Chennai.

BNEC has a highly qualified faculty team with many professors holding doctorate degrees. The college also has well-equipped labs and a library with a vast collection of resource materials.

In terms of research, the department of Mechanical Engineering has a recognized and collaborative research centre approved by Anna University, Chennai. BNEC has several ongoing projects in various fields, including renewable energy and communication networks. The college has also collaborated with many industries and research organizations to provide students with hands-on experience and exposure to real-world problems.

NRD Educational Trust also runs a polytechnic college in the name of Bharath Niketan Polytechnic College (BNPC) located near BNEC. BNPC offers six Diploma courses (Diploma in Agricultural Engg., Civil Engg, CSE, ECE, EEE & MECH)

ISBN



9 789361 639890



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