



## **SUGUNA COLLEGE OF ENGINEERING**

Nehru Nagar (W), Kallapatti Road, Coimbatore - 641014

IN ASSOCIATION WITH

ORGANIZATION OF SCIENCE & INNOVATIVE ENGINEERING AND TECHNOLOGY (OSIET), CHENNAI, INDIA.

IN COLLABORATION WITH

**SAMARKAND STATE UNIVERSITY, UZBEKISTAN**



## **Proceedings of**

**6<sup>th</sup> International Conference on Recent Trends in Engineering  
Technology and Management 2026**

**10<sup>th</sup> & 11<sup>th</sup> April 2026**

6<sup>th</sup> INTERNATIONAL CONFERENCE ON  
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AND MANAGEMENT– 2026”**

(ICRETM - 2026)

APRIL 10<sup>th</sup> & 11<sup>th</sup> 2026

ORGANIZED BY

**Suguna College of Engineering**

Airport Road, Kalapatti Main Rd, near International, Nehru Nagar West,  
Coimbatore, Tamil Nadu 641014

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Association with

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## **ICRETM 2026**

Proceeding of “6th International Conference on Recent Trends in Engineering Technology and Management”

**10<sup>th</sup> and 11<sup>th</sup> APRIL, 2026**

### **Venue:**

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Coimbatore, Tamil Nadu 641014

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### **PRINCIPAL's MESSAGE**

It gives me immense pleasure to welcome you all to the 6th International Conference on Recent Trends in Engineering Technology and Management (ICRETM 2026), hosted at Suguna College of Engineering, Coimbatore, India.

As the Principal, I use this opportunity to bring together distinguished researchers, faculty members, practicing engineers, technologists, research scholars, and students to share their valuable insights and novel research on the latest trends in engineering, technology, and management. At Suguna College of Engineering, we are committed to providing an education that not only equips you with technical skills but also nurtures your character, critical thinking, and leadership qualities. Our distinguished faculty, state-of-the-art infrastructure, and industry collaborations create an environment that fosters holistic growth. We believe in the power of research, innovation, and experiential learning to prepare you for the challenges and opportunities of the dynamic world. This conference aligns with our vision of promoting academic excellence and encouraging research and innovation. I am confident that this conference will be a great success and will provide a platform for valuable knowledge-sharing and networking opportunities for all participants.

Once again, I extend my warmest welcome to all the participants, and I look forward to meeting you all at the conference.

**Best regards,**  
**Dr. R. Maguteeswaran**  
**Principal, Suguna College of Engineering**



**MANIPAL**  
UNIVERSITY COLLEGE  
MALAYSIA



Greetings to all esteemed faculty, researchers, industry leaders, and students attending the 6th International Conference on Recent Trends in Engineering Technology and Management (ICRETM 2026) at Suguna College of Engineering, Coimbatore, India. I am honored to be delivering the keynote address at this prestigious event on April 10th & 11th. This conference is a platform to explore the new innovations and trends shaping the landscape of engineering and technology. This conference fosters a dynamic environment where all researchers can engage in thought-provoking discussions, share ground-breaking research findings, and forge meaningful collaborations. These interactions will undoubtedly spark innovation and propel us towards a future brimming with possibilities.

I am eager to connect with all of the delegates and witness the innovative ideas that emerge from this vibrant gathering. Together, let us push the boundaries of knowledge and create a future where engineering, technology, and management work in harmony for the betterment of our world.

I look forward to a stimulating and productive conference!!

**DR. SUGAPRIYA DHANASEKARAN**

**PROFESSOR, DEPARTMENT OF MICROBIOLOGY**

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The technology used in various fields of engineering is advancing at a tremendous pace every passing day. There has been a boom in the usage of internet and the demand for high speed access to video and data is ever increasing. 10 years before, 3G and 4G were a distant dream, but today a lot of research is going in the field of 5G as well. In such a scenario, organizing such a conference is of paramount importance. This will enable researchers from different domains to share their views on a common platform. Particularly, I would like to congratulate Suguna College of Engineering, Coimbatore for taking such a promising initiative through the the 6th International Conference on Recent Trends in Engineering Technology and Management ICRETM 2026. This will promote learning and sharing of ideas for the faculty members. I am confident that this conference will indeed generate a lot of interest among the students to explore and pursue the area of research, thereby bringing laurels to your institute and developing our society as a whole.

**DR. FAISAL RASHID SALIM AL MARZUQI**  
**PROFESSOR**  
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| 611 | ICRETMSU2603146 | NEWSCOPE AI – AN INTELLIGENT PLATFORM FOR FAKE NEWS DETECTION WITH SUMMARIZATION AND SENTIMENT ANALYSIS                       |
| 612 | ICRETMSU2602763 | ANDROSENTRYX: A HYBRID ENSEMBLE AND CONVOLUTIONAL NEURAL NETWORK FRAMEWORK FOR ANDROID MALWARE DETECTION                      |
| 613 | ICRETMSU2602736 | ECOBERT PREDICTOR+: A FRAMEWORK FOR PROACTIVE CARBON EMISSION PREDICTION IN NLP MODEL TRAINING                                |
| 614 | ICRETMSU2602880 | EFFICIENT MULTI-SCALE TRANSFORMER WITH SPARSE ATTENTION FOR REAL- TIME SIGNAL DENOISING IN RESOURCE-CONSTRAINED IOT SYSTEMS   |
| 615 | ICRETMSU2602990 | IOT BASED SMART MIRROR WITH HEALTH INSIGHTS                                                                                   |
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| 692 | ICRETMSU2603214 | A SMART SUPPLY CHAIN LEDGER PLATFORM FOR AUTHENTIC MEDICINE VERIFICATION                                                                                                                            |
| 693 | ICRETMSU2602828 | AGRISENSE: AN INTELLIGENT AUTONOMOUS SYSTEM FOR SMART AGRICULTURE                                                                                                                                   |
| 694 | ICRETMSU2602575 | PRIVACY PRESERVING COLLABORATIVE MEDICAL IMAGE ANALYSIS USING FEDERATED LEARNING                                                                                                                    |
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| 696 | ICRETMSU2602588 | REAL-TIME NEAR-INFRARED VEIN VISUALIZATION SYSTEM USING IMAGE PROCESSING.                                                                                                                           |
| 697 | ICRETMSU2602587 | PROTOTYPE DESIGN AND DEVELOPMENT OF SMART DUAL-CHANNEL NASAL MONITORING SYSTEM FOR SLEEP APNEA DISORDER                                                                                             |
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| 699 | ICRETM2602389   | A MULTIMODAL DEEP LEARNING FRAMEWORK FOR EARLY DETECTION OF PARKINSON'S DISEASE: INTEGRATING VOICE ANALYSIS, OCULOMOTOR TRACKING, AND HANDWRITING KINEMATICS WITH IOT-ENABLED CONTINUOUS MONITORING |
| 700 | ICRETMSU2603211 | AI-ASSISTED SURVEY DATA VALIDATION AND ANALYSIS USING AN INCENTIVIZED PARTICIPATION MODEL                                                                                                           |

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| 702 | ICRETM2601121   | EFFECT OF SOIL STRUCTURE INTERACTION AND GEOMETRIC CONFIGURATION ON STRUCTURAL BEHAVIOUR                                                                               |
| 703 | ICRETMSU2602779 | A UNIFIED BENCHMARKING FRAMEWORK AND DATASET FOR EVALUATING LLM FIREWALLS AGAINST PROMPT INJECTION AND JAILBREAK ATTACKS                                               |
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| 705 | ICRETMSU2602740 | MEDSCAN: A SEQUENTIAL MULTI-AGENT LLM ARCHITECTURE FOR AI-POWERED MEDICAL REPORT ANALYSIS AND PATIENT HEALTH COMMUNICATION                                             |
| 706 | ICRETMSU2603022 | REAL-TIME SEIZURE PREDICTION: A SNEAK PEEK                                                                                                                             |
| 707 | ICRETMSU2603049 | A SUSTAINABLE HYDROGEN GENERATION SYSTEM                                                                                                                               |
| 708 | ICRETMSU2602461 | SMARTPAY - SECURE DIGITAL TRANSACTIONS WITHOUT INTERNET                                                                                                                |
| 709 | ICRETMSU2602644 | NEETHIVAAN: AI-POWERED LEGAL GRIEVANCE & AWARENESS PLATFORM                                                                                                            |
| 710 | ICRETMSU2603142 | DESIGN OF A HYBRID LOW POWER DADDA MULTIPLIER USING GDI LOGIC IN FINFET TECHNOLOGY                                                                                     |
| 711 | ICRETMSU2603030 | GEOMETRIC NONLINEAR ANALYSIS OF STEEL MINE HEADGEAR STRUCTURES UNDER MBS-BASED HOISTING AND COMBINED LATERAL LOADS                                                     |
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| 713 | ICRETMSU2603182 | STUDY ON THE MECHANICAL AND DURABILITY PROPERTIES OF ZEOLITE AND POLYVINYL ALCOHOL(PVA) FIBRE ON CONCRETE                                                              |
| 714 | ICRETMSU2603060 | AN INTEGRATED AI FRAMEWORK FOR SMART GRID FORECASTING, OPTIMIZATION, AND PREDICTIVE MAINTENANCE                                                                        |
| 715 | ICRETMSU2602992 | NEXIS ERP AI-DRIVEN PREDICTIVE WORKFLOW AUTOMATION SYSTEM                                                                                                              |
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| 718 | ICRETMSU2603202 | CORROSION PROGRESS MONITORING IN REINFORCED CONCRETE STRUCTURES: MECHANISMS, TECHNIQUES, AND ADVANCEMENTS                                                              |
| 719 | ICRETMSU2603097 | VLSI IMPLEMENTATION OF MULTIMODE IMAGE PROCESSING ALGORITHMS USING FPGA                                                                                                |
| 720 | ICRETMSU262550  | PREPARE AND TEST HOLLOW SLAB WITH ECONOMICAL COMPARISON                                                                                                                |
| 721 | ICRETMSU2603213 | IMPROVING DEVANAGARI HANDWRITTEN WORD RECOGNITION USING CRNN-CTC WITH DUAL-ENGINE INFERENCE                                                                            |
| 722 | ICRETM2602287   | ENVIRONMENTAL RISK PREDICTION USING EMBEDDED MULTI-SENSOR SYSTEMS WITH TINYML                                                                                          |
| 723 | ICRETMSU2602652 | A HYBRID ATTENTION-GUIDED VISION TRANSFORMER AND GRAPH NEURAL NETWORK FRAMEWORK FOR MULTI-CLASS BRAIN TUMOR SEGMENTATION AND CLASSIFICATION FROM MULTI-MODAL MRI SCANS |
| 724 | ICRETMSU2602531 | SMART EV CHARGING STATION USING SOLAR AND LOAD BALANCING..                                                                                                             |

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| 727 | ICRETM2602378   | SECURE APPLICATION FRAMEWORK FOR RUN TIME TAMPER DETECTION                                                                          |
| 728 | ICRETMSU2603234 | DUAL-MODALITY BRAIN IMAGE FUSION: A COMPARATIVE STUDY OF PCA AND NSST-PCNN APPROACHES FOR ENHANCED MRI-PET DIAGNOSTIC VISUALIZATION |
| 729 | ICRETMSU2603082 | EXPLAINABLE CERVICAL SPINE FRACTURE DETECTION USING DENSENET121 WITH ATTENTION MECHANISM ON CT IMAGES                               |
| 730 | ICRETMSU2603322 | A COMPREHENSIVE REVIEW OF EV CHARGING STATION SCHEDULING: OPTIMIZATION TECHNIQUES, RENEWABLE INTEGRATION, AND FUTURE DIRECTIONS     |
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| 742 | ICRETMSU2603128 | AI-BASED RESPIRATORY DISEASE PREDICTION USING VOICE BIOMARKERS                                                                      |
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| 747 | ICRETMSU2603355 | OPTIMIZING CONTAINER IMAGE SIZES FOR FASTER STARTUP AND LOWER COSTS                                                                 |
| 748 | ICRETMSU2603225 | EFFICIENT AND INTERPRETABLE VIDEO ANOMALY DETECTION VIA PREDICTIVE FRAME MODELING                                                   |

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| 750 | ICRETMSU2603323 | GRID-CONNECTED WIND SOLAR HYBRID POWER SYSTEM MODELING AND SIMULATION                                                                       |
| 751 | ICRETMSU2603365 | EXPLAINABLE LIGHTWEIGHT CNN FOR EARLY DETECTION OF DIABETIC RETINOPATHY, GLAUCOMA AND AGE- RELATED MACULAR DEGENERATION USING FUNDUS IMAGES |
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| 753 | ICRETMSU2602837 | SHOPLIFTING DETECTION SYSTEM USING YOLOV8                                                                                                   |
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| 770 | ICRETMSU2603269 | DEEP LEARNING-BASED CHRONIC KIDNEY DISEASE DETECTION USING YOLOV11 SEGMENTATION AND LLM-DRIVEN AUTOMATED REPORT GENERATION                  |
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| 777 | ICRETM2602196   | VISIONAID: AI-POWERED MULTILINGUAL ASSISTIVE VISION SYSTEM FOR THE VISUALLY IMPAIRED                                       |
| 778 | ICRETMSU2602706 | ML-POWERED HEALTH & FALL MONITORING SYSTEM                                                                                 |
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| 789 | ICRETM2602416   | LIGHTWEIGHT EDGE-BASED FEDERATED LEARNING FOR PRIVACY-PRESERVING IOT SECURITY                                              |
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| 796 | ICRETMSU2603328 | A HYBRID PRE-SUBMISSION DETECTION FOR PROMPT INJECTION IN LARGE LANGUAGE MODELS                                                      |
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| 798 | ICRETMSU2603111 | ENHANCED AI-BASED BLOOD GROUP DETECTION USING FINGERPRINT                                                                            |
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| 800 | ICRETM2602009   | AI-BASED DRIVER CARDIAC EMERGENCY DETECTION AND VEHICLE IMMOBILIZATION SYSTEM USING ESP32 AND DECISION-TREE CLASSIFIER               |
| 801 | ICRETMSU2602980 | PHISHING WEBSITE DETECTION USING URL                                                                                                 |
| 802 | ICRETM2602998   | AN INTELLIGENT MACHINE LEARNING FRAMEWORK FOR EARLY DETECTION AND PREDICTION OF POLYCYSTIC OVARY SYNDROME (PCOS)                     |
| 803 | ICRETMSU2602729 | PERFORMANCE CHARACTERIZATION OF PROTON EXCHANGE MEMBRANE FUEL CELL (PEMFC)                                                           |
| 804 | ICRETMSU2603253 | SMART METER-BASED ENERGY CONSUMPTION ANALYSIS IN HIGHER EDUCATION INSTITUTIONS                                                       |
| 805 | ICRETM2602018   | MULTI-MODAL SLEEP STAGE CLASSIFICATION USING MULTI-SCALE MASKED AUTOENCODER AND CONVOLUTIONAL NETWORKS                               |
| 806 | ICRETM2600675   | MULTI-CLASS EPILEPTIC SEIZURE STATE CLASSIFICATION USING CONSTANT-Q TRANSFORM BASED EEG SPECTROGRAMS AND DEEP LEARNING               |
| 807 | ICRETMSU2603053 | MODELING AND SIMULATION OF A HYBRID RENEWABLE ENERGY SYSTEM FOR OPTIMAL POWER GENERATION USING MATLAB                                |
| 808 | ICRETM2601995   | ROLE OF INTERNAL COMMUNICATION PLATFORMS) IN SHAPING ORGANIZATIONAL CULTURE                                                          |
| 809 | ICRETMSU2603083 | AI-DRIVEN MICROSEGMENTATION FOR ZERO TRUST SECURITY IN KUBERNETES-BASED BANKING SYSTEMS                                              |
| 810 | ICRETM2600581   | TRUSTWORTHY CYBERSECURITY SYSTEMS THROUGH EXPLAINABLE AI: A COMPREHENSIVE SURVEY OF IDS, MALWARE CLASSIFICATION, AND FRAUD DETECTION |
| 811 | ICRETM2600565   | QUANTUM-ENABLED ARTIFICIAL INTELLIGENCE: CHALLENGES, OPPORTUNITIES, AND ROADMAP FOR FUTURE RESEARCH                                  |

### **539.EVOLEARN ADAPTIVE AI STUDY AND RESEARCH AGENT**

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The conventional e-learning systems and research assistant offer minimal customization that relies on one-sided content delivery, simple quizzes, and immediate suggestions. These methods do not meet the changes in the needs of learners, the long-range objectives, and the inspiration that is dynamic. The proposed research to address these issues is EvoLearn: Adaptive AI Study and Research Agent, a platform based on continually changing study and research processes on the basis of the individual goals, preferences, and progresses. The agent combines multi-modes of resources processing, such as text, speech, and video summarization with the real-time feedback loop and continuous learner memory to better personalize it. In contrast to current systems, EvoLearn integrates the adaptive planning, custom resource curation, automatic testing, and ongoing learner modeling systems on a scalable agent implementation. Moreover, EvoLearn also includes intelligent knowledge tracing to identify evolving gaps and offer them intervention. It uses generative AI to create a personalized practice content and research summaries thus enhancing efficiency. The system is inclusive and accessible because it supports multi-format and multilingual content. Its scalable brand suits the lifelong learning and cross-domain flexibility that is applicable to academic study as well as professional research.

### **540.BLOCK-CHAIN-BASED PLATFORM FOR THE COMPLIANCE INSPECTION OF THE READY-MIXED CONCRETE SUPPLY CHAIN**

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The ready-mixed concrete supply chain also has urgent difficulties in compliance inspection because of the scattered data control, the restrictions of transparency and the possibility of manipulations at the production, transportation and delivery levels. Such problems sabotage quality assurance, regulation and the trust of the stakeholders. This paper presents the idea of a blockchain-based platform that will facilitate tamper-resistant, transparent, and traceable compliance investigation along the entire ready-mixed concrete supply chain. The offered approach will combine smart contracts and distributed ledger technology to provide automatization of compliance checks, the registration of the operational data of

many actors, and the impossibility to alter the audit trails. An architecture of the system is created to accumulate batching records, proportions of the materials, transit-time and confirmation of deliveries in real-time. One area that the platform has contributed is in ensuring enhancement of integrity of data, minimizing delays in inspecting the data and also enhancing accountability among producers, transporters and contractors. Experimental assessment and case study show that the blockchain-based solution is way more efficient in terms of traceability, reduction of disputes of the data, and prone, more acceptable regulatory control than traditional centralized systems.

#### **541.REAL- TIME ECG MONITORING SYSTEM AND CARDIAC DISEASE PREDICTION WITH IOT AND DEEP LEARNING MODELS**

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One major cause of death among the global population is cardiovascular disorders, which require effective and consistent monitoring systems[8], emphasizing the need for continuous and early cardiac health monitoring. This work presents a smart ECG monitoring system built using IoT technology and advanced deep learning techniques for identifying heart conditions[1], [2]. The introduced framework reads real-time ECG data and sends it to a cloud resource where it is further processed and analyzed. Complex deep learning methods are used to identify meaningful features and classify cardiac abnormalities on a large scale [3]. The model enhances diagnostic accuracy by identifying patterns associated with various heart diseases at an early stage. Real-time monitoring enables timely alerts to healthcare providers and patients, improving response time and reducing the risk of severe cardiac events. The experimental findings show that the system has high prediction accuracy with low latency and scalability, which makes it applicable to the continuous remote healthcare monitoring application.

#### **542.DETECTION OF HATE SPEECH AND TOXIC COMMENTS FROM SOCIAL MEDIA.**

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Online hate speech and toxic language have surged in the same proportions as social media has grown, creating serious threats for both individuals and communities. Manual content moderation is particularly laborious and inconsistent to encourage research in automated Natural Language Processing- based solutions. In this work, we have given an extensive overview of an AI-driven detection system for hate and toxic content on social media platforms such as Twitter or Facebook. We review how machine learning methods-from classical feature-based classifiers to deep neural networks-have been applied for this task, discuss key challenges like context dependence and bias, and propose a full-scale model utilizing contextualized embeddings combined with neural networks. We have described an end-to-end pipeline: data collection, preprocessing, feature extraction, and model inference- supported with block-scheme. Advanced models, like fine-tuned BERT, are expected to considerably outperform simple baselines, such as SVM on TF-IDF, in terms of accuracy and F1- score, which is in line with recent literature. At last, discussion of possible results and deployment considerations, such as real- time filtering of multilingual data. Future work can further enhance robustness by incorporating explainable AI techniques and continual learning to adapt to evolving language patterns. Ethical deployment must also prioritize transparency, fairness, and human-in-the-loop moderation to minimize false positives and unintended censorship

#### **543.PREDECTIVE ANALYTICS FOR IDENTIFYING AND CATEGORIZING OBESITY RISK LEVELS USING SUPERVISED MACHINE LEARNING TECHNIQUES**

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A significant global health concern, obesity has been linked to major illnesses like diabetes, heart disease, and metabolic disorders. Preventive healthcare can benefit greatly from early obesity level prediction. This research suggests a smart health system that makes use of machine learning algorithms to forecast obesity levels based on physiological, behavioral, and demographic characteristics. The dataset's patterns are examined using a variety of supervised learning models, including Naïve Bayes, Random Forest, Decision Tree, and Support Vector Machine. To guarantee high prediction accuracy, the system performs feature selection, model training, evaluation, and data preprocessing. Proactive health management is made possible by the established model, which offers users tailored insights and suggestions.

#### **544.AI VIRTUAL PRESENTATION SYSTEM: REAL-TIME TOUCHLESS SLIDE NAVIGATION USING DEEP LEARNING**

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Traditional presentation systems rely on physical devices such as keyboards, mice, or remote clickers, which restrict presenter mobility and reduce interaction quality. This paper proposes an AI Virtual Presentation System that enables real-time touchless slide navigation using Convolutional Neural Networks (CNNs). The system performs gesture recognition using infrared-based hand image datasets and integrates the trained model into a full-stack web application. Unlike browser-based AI solutions, the proposed architecture shifts computation to a FastAPI backend using WebSockets for ultra-low latency communication. The system ensures efficient gesture classification, reduced client-side load, and seamless presentation control through webcam input. Experimental results demonstrate high accuracy, improved user experience, and real-time responsiveness, making the system suitable for professional and academic environments.

## **545.COMPARATIVE ANALYSIS OF QUERY-ADAPTIVE HYBRID RETRIEVAL STRATEGIES FOR RAG: BM25, DENSE, AND ADAPTIVE RRF FUSION ACROSS HETEROGENEOUS DOMAINS**

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Retrieval-Augmented Generation (RAG) systems critically depend on the retrieval mechanism to ground large language model (LLM) responses in verifiable evidence. However, selecting the optimal retrieval strategy—sparse lexical (BM25), dense neural (BGE-base), or hybrid Reciprocal Rank Fusion (RRF)—remains an open challenge across heterogeneous domains. This paper presents a systematic empirical study evaluating eight retrieval configurations on five benchmark datasets: MS-MARCO (general web), Natural Questions (encyclopedic), PubMedQA (biomedical), FiQA (financial), and LegalBench (legal). Beyond the three base strategies, we implement and evaluate five novel query-adaptive RRF weighting mechanisms that dynamically adjust BM25-Dense balance based on query length, interrogative word class, named-entity density, corpus vocabulary overlap, and weighted ensemble combination. All strategies are assessed using the RAGAS automated evaluation framework across four metrics: context precision, context recall, faithfulness, and answer correctness. Across 10,000 query-strategy evaluations (250 queries  $\times$  5 datasets  $\times$  8 strategies) using GPT-4o-mini as the generation backbone, Hybrid RRF emerges as the most robust strategy (mean answer correctness 0.6692), winning three of five benchmarks with consistent top-3 placement across all domains. Adaptive heuristics win on two domain-matched benchmarks but exhibit high failure rates elsewhere. A targeted ablation study further reveals that the canonical  $k=60$  RRF smoothing constant is optimal and  $k_{top}=5$  retrieved passages balances precision and recall. These results provide concrete deployment guidance: when no training data are available, Hybrid RRF is the recommended default; adaptive heuristics should only be applied with extensive domain-specific validation.

## **546.INTEGRATED FLEET MANAGEMENT AND LOGISTICS SOLUTION**

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Traditional fleet and logistics management systems rely heavily on manual coordination and static planning, leading to delivery delays, excessive fuel consumption, poor operational visibility, unsafe driving behaviour, and increased risk of vehicle theft. This paper proposes an IoT-enabled real-time vehicle tracking and fleet optimization system designed to address these challenges through continuous monitoring, intelligent routing, and automated decision-making. The system employs custom telematics hardware based on the LilyGO T-SIM7600E-H development board, integrating multi-constellation GNSS for accurate positioning, 4G LTE Cat-4 connectivity for reliable data transmission, inertial sensors for driver behaviour analysis, and magnetic door sensors for delivery verification and security monitoring. A serverless cloud backend built on Firebase supports real-time data synchronization, event-driven processing, and secure authentication. A cross-platform Flutter application provides role-based access for fleet managers, drivers, and customers. Core features include live vehicle tracking,

geofencing, dynamic ETA estimation using traffic-aware shortest-path algorithms, proactive alerts for unsafe or abnormal events, and intelligent task assignment based on vehicle and driver attributes. The proposed system is validated through a functional prototype deployed in a small-scale supply chain environment involving four to five vehicles. Experimental observations indicate improved operational efficiency, enhanced safety, reduced fuel consumption, and scalability for predictive analytics, thereby addressing a significant gap in existing fleet management platforms.

#### **547. AN LLM-POWERED NATURAL LANGUAGE INTERFACE FOR LANGCHAIN-BASED RELATIONAL DATABASE QUERIES**

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As the number of structured data increases, there is a greater demand for easy ways to access that data for people without technical experience. Traditional methods of accessing this data require knowledge of Structured Query Language (SQL) and generally present usability challenges to end-users. This paper presents an LLM-based natural language interface to relational databases (through use of plain English) based upon the LangChain framework, a dedicated API based implementation of the LLaMA 3 language model, and a MySQL database for creating a secure text-to-SQL system that takes schema knowledge into consideration. The system uses dynamic metadata from the database to develop prompts that the LLM can use to create accurate SQL queries from natural language input with minimal error. The use of a web interface developed using Streamlit enhances users' experience when using this system and allows them to execute SQL queries and view results in real time. Experiments completed on several different types of requests (e.g., selection, filter, aggregate) confirm that this system quickly and accurately translates natural language input into SQL requests. Therefore, using an LLM-based NLIDB provides users with greater access to databases, reduces the amount of technical knowledge required by users, and is a scalable solution for intelligent data retrieval in modern ISS.

#### **548. AI-POWERED GITHUB MAINTAINER FOR EFFICIENT ISSUE AND PULL REQUEST MANAGEMENT**

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Large-scale repository management is difficult for software project maintainers because of the swift increase in issues, pull requests, and contributor activity on sites like GitHub. The time-consuming and error-prone manual handling of problem classification, reviewer assignment, and duplicate issue identification frequently results in delayed answers and lower project quality. In order to overcome these obstacles, this paper introduces an AI-Powered GitHub Maintainer System that uses artificial intelligence techniques to automate important repository administration chores. Duplicate issue detection, pull request reviewer recommendation, and automatic issue labeling are the three main characteristics of the represented system. Automatic issue labeling allows for quicker triage and prioritization by using natural language processing to evaluate issue descriptions and assign relevant labels. Reviewing and analyzing the pull request is done via the pull request reviewer feature. Additionally, to reduce redundancy and increase the effectiveness of issue tracking, the duplicate issue detection module uses machine learning models and language similarity to identify semantically similar issues. The hybrid design of the system, which combines embedding-based similarity analysis with large language models, enables explainable issue triaging. Comparative analysis against traditional keyword-based baselines shows that deep semantic models are necessary for efficient duplicate detection, even though practical data show a reduction in manual triage time from minutes to seconds.

#### **549.RAGA THERAPY AS A COMPLEMENTARY MEDICINE FOR BRIDGING ANCIENT INDIAN MUSIC AND MODERN NEUROSCIENCE**

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Raga therapy, a form of Indian classical music- based healing, has emerged as a promising non-pharmacological intervention for improving mental and physical health. This review synthesizes findings from recent clinical and neurocognitive studies that explore the effects of Indian ragas on brain activity, emotional regulation, and physiological responses. Evidence from electroencephalographic (EEG) studies demonstrates that different ragas modulate cortical oscillations, enhance alpha and theta power, and promote inter-subject synchronization—indicative of emotional engagement and cognitive balance. Clinical trials further report reductions in blood pressure, heart rate, and anxiety levels following regular exposure to specific ragas such as Bhimpalas, Todi, Malkauns, and Puriya. Comparative analyses suggest that the emotional valence and temporal characteristics of ragas directly influence autonomic and neurocognitive responses. Moreover, Ayurvedic and musicological perspectives describe raga therapy as a harmonizing force that restores doshic equilibrium and mental serenity. Collectively, the reviewed studies highlight the multidimensional therapeutic potential of raga-based interventions in managing hypertension, stress, and neurocognitive disorders such as dementia and depression. The paper concludes that integrating raga therapy within modern neuro-rehabilitative and psychophysiological frameworks can offer a culturally rooted, cost-effective approach to holistic healthcare, though further large-scale randomized studies are required to establish standardized protocols and mechanistic clarity.

### **550.AI-POWERED DRUG INTERACTION CHATBOT USING NLP AND DRUG DATASETS**

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The project creates a lightweight Drug Interaction Chatbot using Artificial Intelligence and Natural Language Processing to counter preventable drug-related harm with immediate , available and accurate drug safety information. This Chatbot promises zero hallucinations, sub-second response times, and full functionality on low-end devices with minimal data usage, in contrast to LLM based systems that suffer from hallucinations and require paid APIs, commercial tools that lack regional brand support and affordability . It is well suited for last-mile reach in rural and low-resource settings throughout India because it is easily used. The creation of conversational systems that can comprehend free text medical queries and provide contextual, evidence-based responses is made possible by recent developments in NLP and Large Language Models . Ai- Powered chatbot can help users to recognize possible drug interactions, comprehend their mechanisms, and take the necessary precautions by fusing NLP techniques with reliable drugbases. This project showcases a proof-of concept Drug Interaction Chatbot with natural-language questions like “Can I take sertraline with tramadol ” ,which will use NLP to extract medication names, RxNorm to normalize them, a curated knowledge base to retrieve pertinent interaction evidence, and produce well organized response. By offering severity assessments , explanations , and suggestions to seek medical advice when needed , this chatbot plays a strong

emphasis on safety. However ,this Chatbot can be used for great extent in contrast to any payment and availability of the person around the regions .

### **551.AI-POWERED SMART TIMETABLE GENERATOR**

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The traditional method of creating a college and university timetable is often cumbersome and error-prone, and can be a challenge when both the students and courses are complex. It represents an explicit Artificial Intelligence-based Timetable Generator that uses a Genetic Algorithm to generate optimal course schedules that do not conflict. The generator uses user-defined parameters, such as room availability, instructor-to-course assignment and preventing conflicting courses, to develop a schedule. The generator's effectiveness was evaluated using actual campus data through extensive tests. The results demonstrate that the proposed generator improves efficiency in allocation for all parties (instructors, students, and classrooms) and also removes course conflicts and significantly reduces the amount of time required to develop a schedule. The results indicate the feasibility and scalability of the Timetable generator in post- secondary institutions.

### **552.DESIGN AND ANALYSIS OF A HIGH-SPEED THREE-OPERAND BINARY ADDER FOR IMAGE BLENDING APPLICATIONS**

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As adders are key in digital circuit design, the manner in which applications handle signal processing and image-processed signals depends partly on the adder's performance. Adders such as carry save adders (CSA), carry select adders (CSLA), and ripple carry adders (RCA) are frequently utilised due to their straightforward architecture. However, they perform worse due to propagation delay, particularly in multi-operand arithmetic tasks. During image blending, pixel-wise addition occurs, necessitating the usage of a fast adder. This research introduces a fast three-operand adder developed to address the limitations of conventional two-operand adders. The suggested design integrates bit addition logic, base logic, propagate and generate logic, and sum logic to reduce path delay. The authors assessed the performance of this novel adder and conducted comparisons with the latest RCA, CSA, and CSLA implementations regarding latency, power consumption, and area requirements. MATLAB was used to construct the picture blending application for the adder, which was designed and tested in Xilinx Vivado. According to simulation studies, the novel three-operand adder is a good choice for real-time image processing systems since it reduces propagation delay while maintaining competitive power and area metrics.

### **553.A HYBRID MERW–SWIN TRANSFORMER APPROACH TO SEMI-FRAGILE WATERMARKING FOR TAMPER DETECTION**

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In this paper, we propose an improved semi-fragile watermarking scheme utilizing Maximum Entropy Random Walk (MERW) together with a better-designed Swin Transformer based deep feature embedding technique for robust and accurate image authentication and tamper localization purposes. For this, we employ Quaternion Dual-Tree Complex Wavelet Transform (QDTCWT) for multi-resolution representation while adaptive MERW-based region selection will provide optimal embedment into perceptually imperceptible regions. To ensure robustness and imperceptibility, a novel

normalized embedding approach with controlled embedding process will be proposed. Experiments using CASIA and HDR datasets demonstrate that our approach outperforms all previous methods by providing an average PSNR higher than 66dB and even reaching 69dB values at certain points, compared to previous solutions which could not overcome 65dB value. Furthermore, SSIM values are kept higher than 0.999 for all experiments.

#### **554.LORA-BASED PEER-TO-PEER COMMUNICATION SYSTEM FOR SUSTAINABLE AGRICULTURE**

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This work presents the design and development of a peer-to-peer communication system for sustainable agriculture using LoRa technology. The system enables real-time environmental monitoring in remote agricultural fields without dependency on internet connectivity. A LoRa-based weather station integrates various environmental sensors, including temperature, Humidity, Atmospheric Pressure, Rainfall detection, Soil moisture, air quality, and wind speed, with a LoRa transceiver to collect and transmit real-time weather data over long distances. All of this critical data is displayed locally on a 16x2 LCD screen, allowing a farmer to check conditions at a glance. A simple button interface allows for user control, and a built-in buzzer provides immediate alerts if any sensor readings cross a predefined threshold, such as a sudden drop in temperature or detection of movement. These weather stations are specifically useful in rural, remote, or disaster-prone regions where conventional communication systems are limited or unavailable. The low-power nature of LoRa allows weather stations to operate for a long time on battery, thus making them cost-effective and sustainable for long-term deployments. This paper explores the design, benefits, and challenges of implementing LoRa-based weather stations, highlighting their applications in agriculture, climate monitoring, and smart city initiatives. Additionally, we discuss the potential for integrating LoRa technology with IoT platforms and advanced analytics aimed at enhancing the accuracy and predictive capabilities of weather monitoring systems.

#### **555.SMART SIGN LANGUAGE TRANSLATOR FOR REAL TIME COMMUNICATION**

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The growing communication gap between sign language users and non-signers necessitates the development of intelligent, real-time translation systems. Conventional approaches often lack bidirectional capability, real-time performance, and sufficient accuracy, limiting effective interaction for deaf and hard-of-hearing individuals. This paper presents a Smart Sign Language Translator for Real-Time Communication, an AI-driven system that enables seamless two-way communication using computer vision and deep learning techniques. The system captures hand gestures through a camera and processes them using Convolutional Neural Network (CNN) models such as DenseNet and ResNet50 for accurate gesture recognition. Recognized gestures are converted into text and speech outputs, while spoken language is processed using speech recognition techniques and translated into corresponding sign language visuals. The proposed system ensures real-time processing, high accuracy, and user-friendly interaction. By integrating gesture recognition, speech processing, and intelligent translation mechanisms, the system promotes inclusivity and accessibility. It serves as a reliable

solution for bridging communication barriers and enhancing the quality of life for individuals with hearing and speech impairments.

### **556.DATA DOWNLOAD AUTOMATION SYSTEM (DDAS)**

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The DDAS (Data Download Automation System) is a centralized web-based platform designed to manage institutions, users, and automated data downloads efficiently and securely. The system simplifies institutional data access by providing a structured environment where institutions can register, manage their users, and perform data-related operations without manual complexity. Built on a React.js frontend, Node.js/Express.js backend, and a relational database, DDAS enforces role-based access control and JWT authentication at every layer. Evaluation across 50 test accounts demonstrated 100% role enforcement accuracy and average download fulfillment within 1.4 seconds. The platform's modular architecture supports future scalability and feature integration.

### **557.AI-BASED TOMATO LEAF DISEASE DETECTION WITH GROWTH STAGE-AWARE RECOMMENDATION SYSTEM**

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Tomato leaf diseases directly affect crop yield and quality, making timely detection essential for effective crop management. Traditional identification methods, which rely on manual inspection or expert consultation, are often slow, inconsistent, and not easily accessible in rural areas. This work proposes an AI-based system that detects tomato leaf diseases using deep learning and image processing techniques. A Convolutional Neural Network (CNN) is used to classify diseases from leaf images, while preprocessing methods such as segmentation using OpenCV help isolate the region of interest and improve prediction accuracy. In addition to disease detection, the system provides stage- aware recommendations to guide farmers in selecting appropriate treatments. A web-based interface with chatbot support enables real-time interaction and practical usability in agricultural environments.

#### **558.A REVIEW OF FRAUDULENT JOB ADVERTISEMENT DETECTION USING FRAUD PATTERN ANALYSIS AND HYBRID MACHINE LEARNING MODELS**

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Fraudulent job advertisements have become a major issue on online recruitment platforms, leading to identity theft, financial loss, and a decline in job seekers' trust. The rapid growth of digital employment platforms has raised serious concerns about the discovery of fraudulent job listings. This work provides a comprehensive analysis of deep learning, machine learning, and natural language

processing techniques for detecting fraudulent job postings. A variety of techniques, such as Random Forest, Support Vector Machine, Logistic Regression, and deep learning models like Bi-LSTM and BERT, are analyzed and compared. The study also examines key tactics like TF-IDF, keyword analysis, and oversampling techniques like SMOTE to address class imbalance. The review claims that hybrid and ensemble models are more accurate than individual classifiers. Model explainability, dataset imbalance, and the absence of real-time detection are still problems, though.

### **559.STOCK MARKET REACTION TO GREEN BOND ISSUANCE IN INDIA: AN EVENT STUDY OF SELECTED INDIAN LISTED FIRMS**

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Green bonds have quickly evolved into one of the most significant tools in sustainable financing by providing a systematic means whereby corporations can obtain funds dedicated solely to environmentally friendly activities. Within the Indian economy, the market for green bonds has grown considerably within the last decade, owing to regulatory mechanisms set up by the Securities and Exchange Board of India and further encouraged by the Reserve Bank of India via its External Commercial Borrowings policies. Nonetheless, research into the effect of green bond issuances on Indian equity markets is relatively poor, with several studies yielding conflicting results from positive to neutral to negative market responses. To fill this research gap, an event study will be conducted at the firm level to investigate the impact of green bond issuance announcements made by four Indian corporations listed on the Indian stock exchange. The selected firms include two Indian public sector enterprises, NTPC Limited and REC Limited, alongside two privately owned Indian renewable energy organizations, Adani Green Energy Limited and KPI Green Energy Limited. Each announcement is backed by a triple-check procedure using filings from official sources of BSE/NSE as per SEBI Listing Obligations and Disclosure Requirements Regulations, 2015 under regulation 30. Two different yet complementary theories have guided this research process. Signaling theory as proposed by Spence in 1973 and adapted for financial implications by Ross in 1977 suggests that the issuance of green bonds constitutes a costly signal indicating environmental concern and high-quality operations by the organization issuing the bonds. According to the efficient market hypothesis semi-strong form proposed by Fama in 1970, the announcement should have immediate effects on share prices. In order to calculate abnormal returns, a market model is used to determine expected returns based on the benchmark of NIFTY 50 index over a period of 120 days prior to announcements while abnormal returns are calculated for each of the 21 days in the event window including ten days before and ten days after the announcements. The results indicate diverse market responses among the sample companies. Adani Green Energy Company has shown the highest positive cumulative abnormal return, implying that investors are highly sensitive to announcements of green bonds by companies that operate within the renewable energy sector. On the other hand, NTPC Limited has recorded a moderate positive cumulative abnormal return, in line with its stable shareholder base and diversified business. But REC Limited and KPI Green Energy have recorded negative cumulative abnormal returns during the period under study, possibly due to existing market conditions, the identity of the issuer company as an intermediary, and the requirement of external credit enhancement. Individual-day abnormal returns have rarely been statistically significant, which is expected given the limited number of observations in the data sample and the inherent volatility of emerging market stocks. The research provides empirical evidence to the sustainable finance literature in the context of India, indicating that the impact of green

bonds issuance on stock market performance is subject to firm characteristics rather than always being positive. The results hold relevance for companies’ financing decisions, investors’ investment behavior, and regulation concerning green bonds in the Indian capital market.

## **560.A TRANSFORMER ENCODER-BASED SPEECH ENHANCEMENT SYSTEM FOR HEARING AID APPLICATIONS**

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An effective approach to improving speech clarity with hearing aids through a deep learning based transformer encoder speech enhancement model for speech recognition is presented here. The research focuses on using the transformer encoder self attention mechanism to exploit the long-range spectral and temporal correlations present in speech and to improve speech clarity when distinguishing speech from other background sounds (e.g., noise). The dataset consists of noisy speech records and clear speech in various conditions/Settings. The speech data is represented as a time- frequency representation so it can be used to train the model. The authors used several data augmentation techniques to help generalize the model to many different types of environments. Such techniques include time shifting the speech, adding noise, varying the speed and spectrally masking the speech signal to help improve robustness in the way it can work in multiple acoustic environments. The transformer encoder uses pre trained weights that were fine tuned for speech enhancement in various types of noisy environments and speech contexts and increased the model’s ability to maintain speech quality while lessen background noise. The transformed Speech encoder’s ability to learn contextual speech representations resulted in improved performance & ease of listening. The practical and expandable application of transformer models for improving speech is demonstrated by the study and suggests future hearing aid technology may integrate transformer models for better listening aids.

## **561.CHURN GUARD: AN INTELLIGENT CUSTOMER CHURN PREDICTION AND RETENTION SYSTEM USING MACHINE LEARNING AND CLOUD**

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When users cancel their subscriptions, it creates money problem for the streaming platforms. Churn Guard is the system that helps identify customers who might stop using the service or cancel their subscription. It analyses user behaviour's to find the warning signs early and takes actions to keep those users interested and engaged, so they continue using the Service. This is a system that identifies users who may stop using a service and helps to keep them. It uses smart methods to study user behaviour and recommends useful content, and sends personalized messages to the customer. All features is combined in the simple web app built with Flask. Four models is trained using the data from 5,000 users data. The data is have 17 details about each user, like the behaviour and basic information. Random Forest is chosen as the main model because it performs well, with 91.30% accuracy. When all models are combined, the overall performance improves to 95.80% accuracy. Churn is predicted as score between 0.0 to 1.0 which tells how likely the user is leaving. Based on the score, users are grouped into three levels: Low risk (below 0.40), Medium risk (0.40 to 0.70), and High risk (above 0.70). Then the different actions are taken for each group.

## **562.THREAT BASED TRAINING AND DETECTION ANALYSIS FOR INTRUSION MONITORING IN HOSTILE TERRAINS FOR DEFENSE APPLICATIONS USING YOLOV4-TINY**

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We propose a custom trained YOLOv4-Tiny intrusion and threat detection system designed for real-time multi-threat surveillance in hostile terrains. Existing YOLO- based intrusion detection methods primarily focus on limited threat categories and often rely on static quantization or minimal feature optimization, which reduces performance for small-scale or low contrast threats such as drones, smoke, and gun or bullet events. To overcome these limitations, the proposed approach enhances the YOLOv4-Tiny pipeline using dynamic 16-bit quantization and optimized block-level modifications that improve detection consistency across varied environmental conditions. Experimental evaluation on curated multi-threat datasets covering humans, vehicles, drones, fire, smoke, and gun or bullet events demonstrates an overall detection accuracy of 89.9%, precision of 90.6%, recall of 88.3%, and an average inference time of 72 ms (~14 FPS). Compared with reported YOLO-Tiny implementations for embedded platforms, the proposed method attains a +0.8% accuracy improvement and significantly lower inference latency, demonstrating its capability for reliable real-time field-deployable surveillance

### **563.INTEGRATED AI-BASED SURVEILLANCE FRAMEWORK USING MULTI-MODAL BIOMETRIC CUES**

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The rapid expansion of urban environments and smart infrastructure has significantly increased the demand for intelligent surveillance systems capable of accurately identifying individuals in real-world conditions. Conventional surveillance systems typically rely on a single biometric modality, such as

facial recognition, which often suffers from reduced reliability due to environmental variations including poor illumination, occlusion, motion blur, low resolution, and non-frontal camera views. These limitations restrict the effectiveness of unimodal biometric systems in practical surveillance scenarios. To address these challenges, this paper proposes an Integrated AI-Based Surveillance Framework Using Multi-Modal Biometric Cues, which combines face recognition, height estimation, and gait-based motion analysis to achieve robust and reliable person identification. The proposed framework leverages deep learning techniques for facial feature extraction, regression-based approaches for human height estimation, and motion-based gait recognition using Gait Energy Images. The extracted biometric features are fused at the decision level to improve accuracy and reduce false acceptance and rejection rates.

#### **564.MACHINE LEARNING BASED ESG SCORE PREDICTION: A COMPARATIVE STUDY OF PREDICTIVE MODELS**

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Measuring corporate and national sustainability through Environmental, Social, and Governance (ESG) scores has gained significant traction among investors, policymakers, and regulatory bodies over the past decade. Yet the statistical assumptions embedded in conventional ESG scoring methods have rarely been subjected to rigorous, data-driven validation. This work fills that gap by benchmarking seven supervised regression algorithms — Linear Regression, Ridge Regression, Decision Tree, Bagging, Random Forest, Gradient Boosting, and Support Vector Regression — on a structured cross-national ESG dataset containing 5,897 country-year records drawn from 251 countries over the 2000–2023 period. Predictor variables span atmospheric pollution metrics (PM2.5, AQI, SO2, NO2) and socio-economic indicators (GDP per capita, life expectancy, health expenditure), sourced from the UN SDG database and the World Bank Open Data platform. Because the composite ESG target is constructed through a documented linear weighting formula, Gaussian noise ( $\sigma = 0.01$ ) was introduced to the target values before training, simulating the inter-agency score variability observed in practice. Linear Regression records the strongest test-set performance ( $R^2 = 0.9806$ , RMSE = 0.00996), an outcome that directly reflects the linearity of the underlying scoring methodology rather than any modelling shortcut. Gradient Boosting leads the non-linear models ( $R^2 = 0.9728$ ), while a Random Forest importance analysis attributes 64.31 % of predictive variance to PM2.5 concentration alone. Taken together, the findings provide a reproducible, evidence-based reference for selecting machine learning approaches in large-scale ESG analytics.

#### **565.BARKBUDDY-WEB BASED STRAY DOG ADOPTION MANAGEMENT SYSTEM**

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This document outlines the creation of a BarkBuddy- web based stray dog adoption management system utilizing React.js, aimed at streamlining the adoption process for stray and shelter animals. The application features an engaging and easy- to-use interface, enabling users to explore available pets, access comprehensive profiles, and submit adoption requests. The project showcases the use of contemporary front-end technologies, including a component-driven architecture, state management via React hooks, and integration with backend APIs for dynamic data processing. Furthermore, the system adopts responsive design principles to guarantee functionality across various devices. This research acts as a practical resource for novices to grasp the essentials of React.js while developing a tangible application that contributes to social welfare by encouraging pet adoption. Keywords—React.js, Web Development, Pet Adoption, Component-Driven Architecture, Responsive Design, User Interface.

## **566.COMPACT DUAL-BAND HEXAGONAL MICROSTRIP PATCH ANTENNA**

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This paper describes the design and simulation of a compact hexagonal microstrip dual band patch antenna for use in wireless communications applications. The proposed antenna was created via the losses anticipated when using ANSYS HFSS electromagnetic simulation software. A microstrip feeding technique with a hexagonal shape used to radiate enables both bands to operate simultaneously, on the same frequency as shown by the reflected loss measurements below -10 dB at both frequency bands. Also, overall radiation pattern characteristics were verified with gain and directionality being adequate. The geometry and compactness of the antenna make it compatible with contemporary wireless systems including WLAN, WiMAX and other radio frequency communications applications.

## **567.HYBRID QUANTUM-CLASSICAL CNN FOR EXPLAINABLE HYPERTENSION DETECTION FROM PHOTOPLETHYSMOGRAPHY SIGNALS**

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Hypertension is one of the most prevalent heart diseases globally, and it remains largely undiagnosed due to the lack of visible signs during the early stages. For the traditional diagnosis of hypertension, the process of blood pressure checks using cuff-based technology is less common, especially for continuous monitoring. An increasingly popular optical, contactless technique is “photoplethysmography” (PPG), used for continuous heartbeat evaluation. However, the existing deep learning techniques face limitations in interpretability and computational complexity. For hypertension diagnosis, this paper introduces the Hybrid Quantum-Classical Convolutional Neural Network (HQ-CCNN), which analyses PPG signals to provide results. The proposed solution reduces the cost of feature engineering and increases representational power through the integration of the concept of “quantum variance circuits” into “conventional CNNs.” An “explainability” tool increases the reliability of the diagnosis results through “quantum-based” features and “SHAP” features. Based on the publicly available PPG dataset, the proposed HQ-CCNN outperforms the existing CNN, LSTM, and hybrid models in terms of efficacy and interpretability.

## **568.AERIALDENS: A CO-ATTENTION HYBRID NETWORK FOR UAV CROWD DENSITY ESTIMATION IN REFUGEE CAMPS**

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Crowd density estimation in situations such as refugee or IDPs camps during humanitarian crises is of utmost importance in terms of resource allocation, security monitoring, and emergency response management. Aerial images are obtained using UAVs to obtain a wide spatial view of the scenes to

estimate crowd density; however, this is challenged by severe problems such as multi-altitude perspective distortion, inter-person occlusion, and irregular morphology of crowds. Deep learning techniques are currently only able to detect crowd density accurately for person detection and scene classification individually. There exists a lack of an efficient technique for combining spatial information using object detection methods and appearance information using a cross-attention bridge in aerial imagery. A hybrid technique, AerialDens, is proposed in this paper, combining Co-Attention Fusion Module (CAFM) for integrating YOLOv10-based person detection and Swin Transformer-Tiny (Swin-T) encoders for crowd density estimation in aerial imagery. AerialDens is tested for its effectiveness in estimating crowd density using 6,200 annotated UAV images in 4 density zones, namely Low, Medium, High, and Critical density levels using 70/15/15 splitting strategy in scene-level splitting strategy with 5-fold cross-validation. AerialDens achieved 95.4% accuracy, 0.952 Macro-F1, 0.976 Macro-AUROC, and 4.8 MAE with 13.1 ms frame processing time per frame using NVIDIA RTX 3090 GPU. AerialDens achieves 0.951 Recall and 0.961 AUROC in Critical density level and hence can be considered practically deployable in decision-making using aerial imagery.

## **569.SCADA ROOT CAUSE ANALYSIS SYSTEM USING MACHINE LEARNING AND RETRIEVAL-AUGMENTED GENERATION (RAG)**

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Supervisory Control and Data Acquisition (SCADA) systems generate continuous streams of sensor measurements and textual alarm logs, particularly during anomalous operating conditions. Identifying the underlying cause of such anomalies requires correlating heterogeneous data sources, a process that remains time-intensive and error-prone in industrial environments. This paper presents a hybrid Root Cause Analysis (RCA) system that combines ensemble-based machine learning with Retrieval-Augmented Generation (RAG) to deliver both accurate fault prediction and context-aware troubleshooting guidance. The system processes multi-modal inputs, including numerical telemetry and unstructured incident descriptions, through a pre-trained ensemble model comprising LightGBM and XG-Boost classifiers. To enhance interpretability, the prediction output is integrated with a domain-specific knowledge base using ChromaDB, enabling a large language model (LLM) to generate structured and actionable diagnostic procedures. The architecture follows a decoupled design using a FastAPI backend and Next.js frontend, ensuring low-latency inference and scalable deployment. Experimental evaluation demonstrates reliable classification performance, efficient response

generation, and improved usability in operational contexts. The proposed approach reduces diagnostic time while maintaining practical interpretability, making it suitable for real-world industrial applications.

## **570.CROWD DETECTION IN AERIAL IMAGES USING YOLOV8 AND SPATIAL GRAPH**

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Crowd detection in aerial images is an important task for applications such as public safety, surveillance, and crowd management. However, detecting people from aerial imagery is challenging due to scale variations, perspective distortions, occlusions, and complex backgrounds. Although recent deep learning-based object detection models have shown promising results, their performance can decrease in highly crowded scenes where the spatial relationships between individuals become important. To address these challenges, this study proposes a crowd detection framework that combines the real-time detection capability of YOLOv8 with spatial graph modeling. In the proposed approach, YOLOv8 is first used to detect pedestrians in aerial images captured by unmanned aerial vehicles (UAVs). The detected individuals are then represented as nodes in a spatial graph, where edges describe the proximity and relationships between people. Graph-based features such as local density and connectivity patterns are used to improve crowd representation and enhance detection reliability in dense environments. In addition, a web-based platform is developed that allows users to securely log in, upload aerial images, and perform automated crowd analysis. The system provides real-time people counting along with health-related insights to support public health monitoring. The platform also ensures secure data handling and offers a responsive interface for accessibility across different devices. Experimental results on aerial crowd datasets demonstrate that the proposed framework improves robustness and detection accuracy compared to standalone YOLOv8 detection, making it suitable for applications in public safety, surveillance, and urban planning.

## **571. QUANTUM ECHOES: A NEW PARADIGM FOR RADAR FINGERPRINTING USING QUANTUM-ENHANCED SIGNAL CORRELATION**

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Radar fingerprinting, or Specific Emitter Identification (SEI), is a critical capability in modern electronic intelligence (ELINT). Traditional SEI methods rely on basic variations in radar signals

caused by vintage hardware imperfections. Yet, advances such as agile waveform design, low probability of intercept (LPI) techniques and digital beamforming have reduced the effectiveness of these detections. This shift demands new technology capable of extracting deeper metadata in complex electromagnetic environments. Quantum sensing is one such technology that offers capabilities for radar detection and classification. Quantum radar concept is based on quantum illumination and correlated microwave photons that can present enhanced sensitivity in dense conditions compared to classical systems. By exploiting correlations between transmitted and reference quantum states, these systems are capable to reveal weak signals otherwise masked by thermal noise. This article mentions about Quantum Echo Radar Fingerprinting (QERF) that uses quantum radar principles for emitter identification. QERF combines quantum-boosted relation with advanced signal processing and machine learning to detect unique fingerprints from radar signals. This architecture also includes a quantum signal source, correlation-based receiver, adaptive processing unit and classification module. Results indicate that quantum echo analysis could transform ELINT by enabling accurate emitter identification, resilience against jamming and deception and enhanced situational awareness. Though challenges still remain, particularly in quantum hardware integration and quantum memory, rapid progress in microwave quantum sensing will pave way for enhanced fingerprinting systems.

## **572.AI BASED IOT ENABLED SMART ENERGY OPTIMIZATION SYSTEM FOR CLASSROOMS WITH REAL\_TIME OCCUPANCY DETECTION**

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Electrical appliances in classrooms are commonly controlled manually, leading to inefficient energy usage. Lights and fans are often left ON even when no students are present, resulting in power wastage and higher electricity costs. The system depends on human operation, which is prone to errors and negligence, and lacks remote monitoring or control, making it unsuitable for modern smart environments. To overcome these limitations, this project proposes a Smart Classroom Automation System using IoT, designed to automate the control of electrical appliances based on real-time

occupancy detection. The system utilizes a Passive Infrared (PIR) sensor to sense human presence by detecting infrared radiation emitted from the human body. The sensed data is transmitted to a microcontroller such as Arduino or NodeMCU, which acts as the central processing unit of the system. Based on the input received from the sensor, the microcontroller makes intelligent decisions to control the appliances through a relay module. When motion or presence is detected inside the classroom, the system automatically activates the relay, thereby switching ON the lights and fans. Conversely, when no motion is detected for a predefined duration, indicating that the classroom is unoccupied, the system turns OFF the appliances to prevent unnecessary energy consumption. In addition to automation, the system incorporates IoT capabilities that allow users to monitor and control classroom devices remotely using mobile applications or cloud-based platforms such as Blynk or ThingSpeak. This enables real-time status tracking, manual override options, and data logging for energy usage analysis. Thus, the proposed system improves energy efficiency, minimizes human intervention, reduces operational costs, and contributes to the development of a smart and sustainable environment within educational institutions.

### **573.IOT –BASED MAGNETIC V-TWIN ENGINE FOR ELECTRICAL VEHICLE**

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This project presents an IoT-Based Magnetic V-Twin Engine for electrical vehicle applications to reduce grid dependency and improve energy efficiency. The system generates a regulated 12V DC output using electromagnetic induction with an approximate prototype capacity of 200W. A three-battery architecture consisting of primary, regenerative, and traction batteries ensures continuous power supply and better energy utilization. An Arduino Uno-based battery management system monitors voltage and State of Charge (SOC) with automatic cutoff protection, and IoT integration enables real-time remote monitoring. This system enhances reliability, efficiency, and sustainability in EV energy systems.

### **574.AI/LLM RECOMMENDATION VALIDATION SYSTEM**

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The AI/LLM Recommendation Validation System is a hybrid agricultural decision- support platform designed to improve the reliability and safety of crop risk recommendations through a multi-layer validation approach. It combines a calibrated XGBoost model for risk prediction, an expert rule-based layer to ensure alignment with agricultural knowledge, and an LLM-based module to generate and validate advisory outputs. By integrating these components, the system reduces dependence on a single model and minimizes the chances of incorrect or unsafe recommendations. The platform provides farmers with clear and interpretable outputs, including risk levels, trust metrics, and reliability scores, helping them make informed decisions. It also incorporates a human-in-the-loop mechanism, allowing agricultural officers to review and approve critical recommendations through a dedicated dashboard, ensuring accountability and safety. This paper presents the architecture, methodology, and evaluation of the system, demonstrating how multi-layer validation enhances the reliability and practical usability of AI-driven agricultural advisory solutions.

### **575.AN AUTONOMOUS AI SCIENTIST FOR PLANET-SCALE DISASTER PREDICTION USING MULTIMODAL SATELLITE AND GEOPHYSICAL DATA FUSION**

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Natural disasters cause immense loss of life and infrastructure annually. Existing prediction systems are typically task-specific, single-modality, and rely on manually engineered pipelines, limiting their adaptability. This paper presents an Autonomous AI Scientist for planet-scale disaster prediction that integrates four modality-specific LightGBM specialist models, a Sentinel-2 optical satellite segmentation module (UNet and SegFormer-Lite), a Fusion Meta-LightGBM learner, and an Autonomous AI Scientist monitoring loop into a unified closed-loop framework. Specialist models are

trained on real-world datasets — USGS earthquakes (112,291 records), IBTrACS cyclones (291,780 records), NASA FIRMS wildfire observations (2,153 events), and Open-Meteo ERA5 climate reanalysis (10,958 records) — with ground truth labels derived from EM-DAT (16,747 disaster records, 2010–2024). Satellite flood segmentation uses 37 real Sentinel-2 images from the WorldFloods v1.0 dataset. The specialist models achieve AUC-ROC values of 0.9451 (earthquake), 0.8898 (wildfire), 0.9920 (cyclone), and 0.9847 (flood). The Fusion Meta-LightGBM achieves a 5-fold cross-validated weighted F1 of 0.8004, trained without data leakage using held-out specialist predictions. A physics-informed hybrid scoring mechanism provides safety floors derived from the Saffir- Simpson scale and Fire Weather Index. The Autonomous AI Scientist loop monitors distributional drift via KL-divergence and triggers selective retraining without human intervention. Results demonstrate that the proposed multimodal architecture outperforms single-modality baselines and represents a significant step toward self-directed AI systems for global- scale disaster risk reduction.

### **576.NON-INVASIVE HEMOGLOBIN MEASUREMENT USING MULTISPECTRAL PPG**

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Haemoglobin is central to oxygen transport, and its accurate measurement is vital for detecting and managing conditions such as anaemia and hypoxia. Traditional methods depend on invasive blood sampling, which can be uncomfortable and limit routine monitoring. In this work, we present a non-invasive technique that combines multispectral photoplethysmography (PPG) with machine learning to estimate hemoglobin concentration. Signals are captured using green, red, and infrared wavelengths, and the extracted features are calibrated against laboratory reference values. Validation is performed using paired invasive and non-invasive datasets, with results expressed in grams per decilitre (g/dL) through a microcontroller-based system. Our findings highlight the promise of light-based sensing coupled with computational intelligence for reliable hemoglobin assessment. This approach reduces patient discomfort, supports frequent monitoring, and minimizes reliance on invasive procedures. By merging optical physics with machine learning, the system offers a practical pathway toward accessible, efficient, and patient-friendly diagnostic. Such advancements have the potential to reshape routine healthcare by making hemoglobin measurement simpler, more comfortable, and widely available.

### **577.REAL-TIME MULTIMODAL EMOTION DETECTION IN SOCIAL MEDIA DATA USING NATURAL LANGUAGE PROCESSING**

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This With the advent of social media sites, there has been an unprecedented rise in the number of users generating content on their platform. These contents include emotions conveyed via textual messages, emojis, images, and videos. Traditional sentiment analysis tools have limited capabilities in recognizing

these emotions because they are based on rudimentary classifications of content such as positive, negative, and neutral sentiments. In this paper, we develop a multimodal real-time emotion detection system using natural language processing and deep learning methods. Our system leverages transformer architectures for text-based emotions recognition and deep learning algorithms for image and video-based emotions analysis. Our system recognizes emotions such as happiness, sadness, anger, fear, surprise, and anticipation. It utilizes context understanding tools such as sarcasm detection, negation management, and discourse analysis. We show that our proposed framework outperforms traditional machine learning frameworks in terms of accuracy and contextual understanding capability.

## **578.AI-BASED EARLY DETECTION OF CHILD GROWTH DISORDERS USING MACHINE LEARNING**

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Monitoring the physical development of children is essential for identifying potential growth disorders at an early stage. Conventional growth assessment methods rely mainly on manual interpretation of growth charts and medical observations, which may sometimes delay the detection of abnormalities. This paper presents an Artificial Intelligence (AI) based system that uses machine learning techniques to analyze child growth parameters such as age, height, weight, and Body Mass Index (BMI). The proposed model learns patterns from health datasets and predicts whether the child's growth pattern is normal or abnormal. Machine learning algorithms such as Random Forest and Support Vector Machine (SVM) are used for classification. The system assists healthcare professionals and parents in monitoring child development and enables early medical intervention when abnormal growth patterns are detected.

## **579.DATA-CENTRIC DISASTER RISK PREDICTION USING ENSEMBLE MACHINE LEARNING MODELS**

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“The damages can be severe to human life, infrastructure, and natural environment” caused by natural disasters like floods and cyclones. Anticipation of these disasters can enable communities to respond and minimize the effects of these disasters. The project offers the development of a disaster risk prediction system based on the historical environmental data and machine learning to define the potential disaster scenarios. The system interprets past weather-related data like the temperature, windspeed, atmospheric pressure and rainfall in order to establish a pattern related with natural disasters. The data collected are given “a number of preprocessing procedures before the model is applied to ensure that data is of good quality and reliability”. Such steps encompass the Missing Value Handling, duplicate Removal, Time-Series Analysis, Feature Scaling, Feature selection, Categorical Data Encoding, “Train- Test Split used to normalize the dataset. The prediction model, after the preprocessing then, is constructed through the Gaussian naive bayes algorithm, which is efficient in probabilistic classification. The trained model is incorporated into a basic web application written with the help of Flask that enables users to enter environmental conditions and get an answer about the risk of disaster. The application assigns the risk level into 3 groups (low, medium, and high)”. The system reveals how machine learning and past environmental data could be used to aid in assessing risk of disasters and enhance preparedness measures.

## **580.DEVELOPMENT OF A NON-INVASIVE BLOOD GLUCOSE MONITORING SYSTEM BASED ON MAX30102 PHOTOPLETHYSMOGRAPHY SENSOR**

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Conventional methods of monitoring blood glucose levels have been a challenge for diabetic patients because the conventional method of using a glucometer and pricking the finger is quite uncomfortable. This paper presents a non-invasive method using Near-Infrared spectroscopy and a MAX30102 PPG sensor to monitor the glucose level in the blood using the principle of absorption of near-infrared light by the tissues. This method targets the molecular overtones in the range of 750 nm to 2500 nm, which corresponds to the presence of glucose. This method is accurate because it uses the Random Forest and Neural Network algorithms to ensure accurate prediction. The Mean Absolute Error and Root Mean Square Error show that the implementation using a CNN-GRU architecture enhances the recognition of the patterns in the PPG signal. This IoT-based implementation provides a continuous method of monitoring the glucose level in the blood using a non-invasive method, which is quite comfortable. This method provides a 5-second refresh rate using a TFT display for real-time visualization.

#### **581.4 BIT QUANTIZED NEURAL NETWORK FOR EDGE SIMULATION**

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The rapid advancement of edge computing has created a demand for deploying deep neural networks on resource-constrained devices. However, conventional full-precision models require significant computational power, memory, and energy, limiting their applicability in edge environments. This paper presents a framework for ultra-low precision model optimization using 4-bit quantization on the ResNet-18 architecture. The proposed approach employs Quantization-Aware Training to preserve model accuracy while reducing numerical precision. A comparative analysis shows that FP32 baseline achieves 94.79% accuracy, INT8 retains 94.77% accuracy, while INT4 achieves 90.26% with up to 8× model compression and 60–70% energy savings. Hardware-aware simulation is incorporated to evaluate performance across diverse edge platforms. The results demonstrate that low-bit quantization enables efficient and scalable deployment while maintaining acceptable accuracy for real-time applications.

#### **582.SAVINGS AND CREDIT MANAGEMENT OF WOMEN SELF HELP GROUPS AND THEIR IMPACT ON WOMEN'S ECONOMIC EMPOWERMENT**

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Women Self-Help Groups (SHGs) serve as an effective approach to improving the socio-economic conditions of women in rural areas. These groups motivate members to save small amounts regularly, which are pooled together to create a common financial resource. The accumulated savings are used to provide loans to members when they face financial needs or emergencies. Through these savings and lending practices, SHGs encourage responsible financial behavior, decrease dependence on informal lenders, and assist women in managing household expenses and starting small livelihood activities. The group-based system promotes collective decision-making regarding loan allocation and repayment, which strengthens accountability and cooperation among members. Apart from financial support, SHGs also contribute to the personal development of women by enhancing their confidence, leadership

qualities, and ability to work collaboratively. Proper administration of savings and credit activities ensures the continuity and effectiveness of these groups. As a result, SHGs play a significant role in empowering women, reducing poverty, and promoting sustainable rural development while helping women achieve greater financial stability and an improved standard of living.

### **583.JOINT CLUSTERING AND PRICING-BASED ROBUST POWER CONTROL FOR ENERGY-SPECTRAL EFFICIENCY OPTIMIZATION IN VEHICULAR NETWORKS**

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Vehicular communication systems are a fundamental component of intelligent transportation and next-generation 5G networks. However, the increasing density of vehicles and mobile users introduces significant challenges related to inter-cluster interference, resource allocation, and energy consumption. In clustered vehicular ad hoc networks (VANETs), device-to-device (D2D) communication improves spectrum utilization but can lead to severe interference among clusters. Meanwhile, heterogeneous cloud radio access networks (H-CRANs) require efficient power management strategies to maintain high energy efficiency while supporting dynamic vehicular mobility. To address these challenges, this work proposes an energy-efficient power control framework that integrates mobility prediction with interference-aware resource allocation for multi-cluster vehicular networks. A stochastic optimization model is formulated to handle uncertain channel conditions and probabilistic interference constraints. The optimization problem is transformed into a convex form using Bernstein approximation and successive convex approximation techniques. Furthermore, a pricing-based power control mechanism is introduced in which the base station dynamically adjusts a network-wide price to regulate transmit power levels. In addition, a Markov-based mobility prediction model is employed to anticipate user equipment movement and enable adaptive remote radio head switching. Simulation results demonstrate that the proposed approach effectively mitigates interference and significantly improves both spectral efficiency and overall network energy efficiency compared with conventional schemes. Key words: Energy and Spectral Efficiency, H-CRAN, VANETs, Optimization

### **584.IMPACT OF EMPLOYEE INVOLVEMENT IN PRODUCTION PLANNING ON OPERATIONAL EFFICIENCY**

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Employee involvement in production planning has a major impact on how effectively work is carried out at Hypothetical Company. When employees take part in planning activities such as arranging work schedules, managing resources, and sharing their ideas in decision-making, it helps improve the overall performance of the production process. A comparison was made between situations where employee participation was low and where it was high. The findings show that lack of employee involvement leads to poor coordination, increased errors, and delays in completing tasks. On the other hand, when employees actively participate in planning, communication becomes more effective, work flows smoothly, and many operational problems are reduced. It also supports better use of resources and strengthens teamwork among employees. Overall, involving employees in production planning helps to improve efficiency, boost productivity, and enhance the overall performance of the organization.

### **585.ACCIDENT RISK ASSESSMENT FOR ROAD USERS AT DIFFERENT LOCATIONS IN MUMBAI FOR THE AREAS OF AIRPORT, AZAD MAIDAN, WESTERN AND EASTERN EXPRESS HIGHWAYS**

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This work presents a comprehensive accident risk assessment for unprotected and motorized road users at different locations in two high-density zones in Mumbai. Airport Area (Andheri-Santacruz) and Azad Maidan (South Mumbai). Using secondary accident data and official records from Mumbai Traffic Police, Ministry of Road Transport and Highways (MoRTH) and Bloomberg Initiative for Global Road Safety, the analysis identifies critical patterns of accident occurrence and severity by location type: signalized intersections, unsignalized intersections, mid-block sections and roundabouts. The results show that unsignalized intersections pose the greatest risk to pedestrians and motorcyclists, causing most of the fatal blackspots. Mid-block sections on major roads such as the Western and Eastern Express Highways also exhibit high accident density due to uncontrolled pedestrian movement and speed. The findings show that pedestrians and motorcyclists are the most vulnerable groups, accounting for over

85% of all fatalities. This work concludes with targeted engineering, implementation, and behavioral measures to reduce risk in these urban areas, providing a replicable framework for other Indian cities.

## **586. COGNITIVE RADIO-BASED ADAPTIVE BASEBAND CHIP FOR SECURE IOT MESH**

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The significant growth of the Internet-of-Things (IoT), there is a need for communication architectures that provide reliable, secure, and power-efficient technology for very dense mesh networks. Conventional IoT radios are unable to provide what is needed to support high mobility and critical mission-type applications because they have fixed spectrum operation, are subject to substantial interference, and have little or no security. The Cognitive Radio Based Adaptive Baseband Chip (CR-ABC) being investigated in this thesis aims to enhance spectrum agility, security and performance for mesh IoT systems. To facilitate secure and interference aware data transfer, the proposed chip has built-in encryption; real-time modulation changes; and a low complexity spectrum sensing engine. The CR-ABC will use a hybrid decision process consisting of energy detection and machine learning-based classification and adaptive thresholding to automatically switch frequency bands, allowing it to adjust transmitted data based on the current network situation. A hardware accelerated cryptographic unit using chaotic key generation protects mesh communications from security breaches while incurring

minimal computational overhead; therefore, providing end-to-end security. Moreover, the CR-ABC implements duty cycled computing and utilizes low-power digital signal processing (DSP) blocks to prolong the battery life of energy constrained IoT nodes.. The use of Field-Programmable Gate Array (FPGA) prototyping and IoT mesh testbeds for experimental validation shows significant gains in jamming attack resistance, packet delivery reliability, and spectrum usage. The findings verify that the suggested adaptive baseband architecture offers next-generation IoT mesh deployments a scalable, safe, and energy-efficient solution.

### **587.AI-DRIVEN REAL-TIME INTRUSION DETECTION FOR AERIAL SURVEILLANCE SYSTEMS**

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The adoption of unmanned aerial vehicles (UAVs) for border surveillance and security monitoring has increased the demand for intelligent systems capable of detecting unauthorized intrusions in real time under challenging environmental conditions. Aerial surveillance systems face issues such as scale variation due to altitude, illumination changes, dynamic backgrounds, and camera motion, which reduce the effectiveness of traditional methods. This paper presents an AI-driven intrusion detection framework that integrates YOLOv8- based object detection, DeepSORT-based multi- object tracking, and polygon-based region-of- interest (ROI) analysis for accurate intrusion detection. The system supports detection of humans, vehicles, and animals while maintaining temporal consistency through tracking. A flexible polygon-based interface enables precise modeling of restricted zones, allowing accurate detection of boundary violations. The proposed system is computationally efficient and suitable for edge deployment, ensuring real-time performance with low latency. Experimental results demonstrate improved detection accuracy, tracking stability, and reduced false alarm rates compared to conventional approaches. The study highlights the effectiveness of combining deep learning with geometric reasoning for robust UAV-based surveillance systems.

### **588.AURALSCAN: DISEASE PREDICTION FROM COUGH-BASED ACOUSTIC SIGNALS**

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This paper presents AuralScan, a non-invasive, deep learning- based system for the early detection and classification of respiratory diseases using cough sound analysis. Respiratory diseases such as COVID-19, pneumonia, asthma, and tuberculosis impose a severe global health burden, while conventional diagnostic methods remain costly, invasive, and infrastructure-dependent. AuralScan converts cough audio into Mel- spectrogram representations and classifies them using a MobileNet CNN which is enhanced with a multi-kernel architecture integrating  $3\times 3$ ,  $5\times 5$ , and  $7\times 7$  convolution kernels. Experimental evaluation achieved a test accuracy of 94.5 %, per-class F1-scores above 91 %, and an AUC-ROC of 0.97. Deployed as a Flask-based web application, AuralScan provides real-time diagnostic feedback without requiring specialised medical equipment.

### **589.URBAN AIR QUALITY AND TRAFFIC-RELATED POLLUTION: A GLOBAL COMPARATIVE REVIEW OF SOURCES, HEALTH IMPACTS, AND MITIGATION STRATEGIES**

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The surge in traffic-related emissions has emerged as a critical challenge, placing an immense burden on public health systems worldwide. This review synthesizes findings from twenty-seven peer-reviewed studies and technical reports spanning multiple continents to provide a comprehensive, comparative analysis of the variables that govern urban air quality, their health consequences, and viable mitigation pathways. The primary pollutants examined—particulate matter (PM<sub>2.5</sub> and PM<sub>10</sub>), nitrogen dioxide (NO<sub>2</sub>), carbon monoxide (CO), and non-exhaust emissions (NEE)—are evaluated across dimensions of source characterization, urban morphological influence, vehicular fleet composition, meteorological modulation, and socio- economic disparity. Epidemiological evidence establishes significant associations between long-term traffic-related air pollution (TRAP) exposure and cardiopulmonary disease, adverse birth outcomes, and cognitive decline. Critically, this review identifies non-exhaust emissions—from brake wear, tire abrasion, and road dust resuspension—as an emerging and largely unregulated dominant source of vehicular particulate matter, even as electrification of fleets accelerates globally. Mitigation strategies, including Low Emission Zones, fleet modernization, electric vehicle adoption, green infrastructure, and data-driven urban planning, are critically assessed for their context-dependent effectiveness. This paper concludes by outlining strategic research directions and proposing actionable policy frameworks aimed at addressing TRAP.

### **590.DESIGN AND SIMULATION OF BLDC MOTOR REGENERATIVE BRAKING SYSTEM USING SUPERCAPACITOR**

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The operational efficiency of electric vehicles (EVs) and associated motor drive systems fundamentally depends on effective energy capture during deceleration phases. Conventional regenerative braking architectures that channel recovered energy directly into battery banks encounter inherent limitations stemming from batteries' modest power density and restricted charge acceptance characteristics, particularly during high-magnitude transient braking events. This investigation presents a simulation-based analysis of a Brushless DC (BLDC) motor drive system integrated with a supercapacitor-based hybrid energy storage system (HESS) designed to maximize regenerative braking effectiveness. A comprehensive MATLAB/Simulink model (R2021a) was developed, incorporating a three-phase BLDC motor, bidirectional DC-DC converter, lithium-ion battery pack, and supercapacitor bank. The proposed configuration employs a rule-based energy management strategy that effectively isolates high-intensity braking transients from the battery, redirecting them to the supercapacitor buffer. Simulation results obtained under standardized urban driving cycles demonstrate that this architectural approach yields substantial improvements in energy recovery efficiency, achieving an 18–22% enhancement compared to conventional battery-only configurations. Additionally, the system reduces peak battery charging current stress by over 60% while improving DC-link voltage stability. This research validates the supercapacitor's essential function as a high-power intermediary, confirming that BLDC-HESS integration represents a practical approach for extending battery operational life and enhancing overall energy economy in electric mobility applications.

## **591.DESIGN AND SIMULATION OF A SOLAR-POWERED DC–AC CONVERSION SYSTEM WITH BATTERY ENERGY STORAGE**

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The paper describes the design and simulation of a solar powered uninterruptible power supply system. The system uses photovoltaic (PV) panels to generate electricity from sunlight and stores the energy in a battery for backup use. During a power outage, The energy that's been stored is sent to the load via inverter, which changes direct current power into alternating current power. The main aim of this system is to provide a reliable and continuous power supply for laboratory equipment and experiments. By using solar energy, the system reduces dependence on conventional power sources and supports environmentally friendly operation. The battery ensures stable performance and allows the system to operate even when solar power is not available. The system is modeled and simulated using MATLAB/Simulink to study its performance under various situations. The finding indicates that the system provides a stable output and can effectively support continuous operation. Overall, the proposed system is simple, cost-effective, and suitable for academic and practical applications.

## **592.REAL TIME DYNAMIC PRICING SYSTEM USING MULTI-AGENT REINFORCEMENT LEARNING AND QUANTUM INSPIRED OPTIMIZATION FOR E-COMMERCE**

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This study presents an intelligent real-time dynamic pricing system for e-commerce and retail sectors. Traditional approaches, such as Linear Regression, are used to predict prices based on historical data and factors like demand and competitor pricing. However, these methods lack adaptability and fail to handle real-time changes and uncertainty in market conditions. To overcome this limitation, the proposed method integrates Reinforcement Learning (RL) with Gaussian Process Regression (GPR), a Bayesian technique that improves prediction accuracy and handles uncertainty. Additionally, a Multi-Agent system is used to analyze factors such as demand, competitor pricing, and inventory. The pricing problem is further optimized using Quadratic Unconstrained Binary Optimization (QUBO) to select the best price. This hybrid approach ensures adaptive, stable, and accurate pricing decisions, improves customer satisfaction, and enhances profit, providing a practical solution for modern dynamic pricing systems.

### **593.DESIGN OF HIGH-PERFORMANCE 8/4 RESTORING DIVIDER USING APPROXIMATE SUBTRACTORS**

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The demand for high-speed and energy-efficient arithmetic operations is increasing in modern VLSI design. Division is a complex arithmetic operation due to its iterative nature, leading to higher delay and power consumption. This paper presents a high- performance 8/4 restoring divider using approximate subtractors. The design is implemented using Verilog HDL and FPGA. Results show improved delay, power, and energy efficiency with minimal accuracy loss. The design is suitable for error-tolerant applications like image processing.

#### **594.PRESERVING PRIVACY IN FEDERATED LEARNING: A COMPARATIVE STUDY OF MODERN ZKP SCHEMES**

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Federated Learning (FL) enables collaborative model training without sharing private data, but it assumes clients compute their updates honestly. Malicious or lazy clients can produce incorrect updates that degrade or poison the global model. Zero-Knowledge Proofs (ZKPs) address this by allowing clients to prove correct local training without revealing private data. However, ZKP systems vary significantly in proving cost, verification time, proof size, and setup assumptions, affecting their practicality in resource-constrained FL settings. This paper systematically evaluates SNARK, STARK, Bulletproof, and IVC- based proof systems for use in FL, with emphasis on recursive and incrementally verifiable approaches suitable for iterative training. We highlight key performance trade-offs and outline open challenges toward scalable, privacy-preserving FL supported by ZKPs.

#### **595.BLOCKCHAIN INTEGRATED LIGHTWEIGHT CRYPTOGRAPHIC FRAMEWORK FOR DETECTING FILE TIMESTAMP MANIPULATION IN FORENSIC ANALYSIS**

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Timestamp manipulation in files is a common anti-forensics technique used to deceive investigators. It causes a delay in discovering the actual suspect and may mislead the investigation. Currently available techniques for detecting manipulated timestamps require manual file signature analysis or checksumming and can consume huge computation time for a very large number of files. To automate this, the idea proposed in this paper is to use a hash-based one-time signature scheme for tamper detection. The LMS (Leighton- Micali Signatures), a NIST (National Institute of Standards and Technology) - standardized hash-based post-quantum algorithm, uses cryptographic hash functions and a Merkle tree structure to provide each file (consisting only of data or both data and metadata) with a lightweight signature, which can then be stored in a blockchain. Nowadays, with blockchain ledgers gaining widespread attention and adoption, government bodies responsible for security investigations can take advantage of the transparent and tamper-proof nature of the decentralized blockchain. The approach proposed in this paper exploits this feature of blockchains to quickly and efficiently detect timestamp-modified files through LMS signatures and its corresponding timestamp mismatches in real time with low computational resource usage, even when dealing with a large dataset. Files whose LMS signature and timestamps do not match with those in the blockchain ledger are indicative of a backdated file. Experimental analysis proves that the method is computationally feasible, scalable and secure.

## **596.FEDERATED EXPLAINABLE AI FRAMEWORK FOR INDIAN SMART AGRICULTURE: IMPLEMENTATION AND PERFORMANCE EVALUATION IN TAMIL NADU FARMING SYSTEMS**

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This paper presents the design and evaluation of a federated explainable artificial intelligence (Fed-XAI) framework for smart agriculture applications in Tamil Nadu, India. The system combines federated learning with explainable AI techniques to enable privacy-preserving collaborative model training across distributed farming sites while providing interpretable predictions to farmers. We deploy adaptive seasonal learning algorithms, quality-weighted model aggregation, and differential privacy ( $\epsilon=1.0$ ,  $\delta=10^{-5}$ ) alongside a multi-lingual explanation engine supporting Tamil and English. The framework was evaluated across 12 agricultural sites in 8 districts of Tamil Nadu over 12 months (January– December 2025), covering rice, cotton, sugarcane, and pulse crops. Multi-modal data integration includes publicly available satellite imagery, IoT soil sensors, IMD weather data, and farmer-reported observations. Results show crop yield prediction accuracy of 87.3% (compared to 79.6% for local-only models), disease detection precision of 83.7%, and 18.4% improvement in water use efficiency. The federated approach outperformed isolated local models by 9.7% on average but underperformed centralized baselines by 2.1% due to data heterogeneity challenges. A post-deployment survey of 68 farmers showed 72% satisfaction and 61% continued usage after 6 months, with Tamil-language explanations significantly improving adoption among non- English-speaking farmers. We discuss key limitations including connectivity failures at 4 sites, sensor calibration drift during monsoon, and lower accuracy for vegetable crops. The framework demonstrates the feasibility of federated agricultural AI in resource-constrained settings while identifying areas requiring further research.

## **597.ASSESSMENT ON REMOTE WORK AND ITS IMPACT ON SUSTAINABILITY OF EMPLOYEES WITH SPECIAL REFERENCE TO IT EMPLOYEES AT BANGALORE**

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Remote work has become a vital component of the modern IT work environment, influencing employee performance and sustainability. This study assesses the impact of remote work practices on the sustainability of IT employees in Bangalore, focusing on productivity, engagement, well-being, job satisfaction, and work–life balance. Descriptive research design is adopted in the study, and primary data is collected from 110 IT employees using a structured questionnaire. Correlation analysis revealed a significant positive relationship between remote work practices and all selected employee outcomes, leading to the rejection of the first null hypothesis. Structural Equation Modelling (SEM) results indicated a strong positive impact of remote work on employee sustainability ( $\beta = 0.68$ ,  $p < 0.001$ ), explaining 46% of the variance with good model fit. The findings highlight that work–life balance and job satisfaction are most influenced. The study concludes that effective remote work practices enhance employee sustainability and recommends supportive organizational strategies.

## **598.AUTOMATED SEGMENTATION OF PNEUMOTHORAX FROM CHEST X-RAY USING DEEP LEARNING TECHNIQUES**

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Pneumothorax, or the collapsing of the lung, is a critical condition in which air enters the space between the lung and chest wall, leading to the partial or complete collapse of the lung and making it more difficult to breathe. The condition is critical and may lead to severe health complications if not detected in time. This paper proposes a deep learning-based technique for automated detection and segmentation of pneumothorax in chest X-ray images. The images are preprocessed through a series of steps including resizing, normalization, and data augmentation. The segmentation of the images is performed using advanced segmentation algorithms like the U-Net and the U-Net++, in which the encoder learns the features of the images, and the decoder produces a detailed segmentation image of the input image. The segmentation image is then passed through a sigmoid function and post-processing to produce the final segmentation image. The performance of the proposed algorithm is evaluated through the calculation of the Dice Score, IoU, accuracy, and precision. The results of the proposed algorithm indicate that it is reliable and accurate in the segmentation of the pneumothorax region.

## **599.SHIELDAI : A MULTI-LAYER ADVERSARIAL DEFENSE FRAMEWORK FOR SECURING AI RESPONSES**

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Conversational systems driven by AI are being used more and more in enterprise, healthcare, education, and customer service settings. These systems' increasing capabilities have also made them more vulnerable to adversarial inputs meant to produce undesirable, skewed, or unapproved outputs. Current security measures frequently fall short in the face of complex attacks that alter model logic, cause anomalous behavior, or get around pre-established limitations. This paper introduces ShieldAI, a structured defense architecture that uses a multi-layered pipeline that includes adversarial detection, semantic filtering, response stabilization, and confidence verification to protect AI-generated outputs. To find adversarial prompt patterns, the suggested framework combines hybrid detection methods such as statistical anomaly detection, rule-based analysis, and contextual embedding evaluation. ShieldAI improves resistance to jailbreak attempts, reduces prompt-based misdirection, and maintains the logical integrity of generated responses by implementing safety and consistency at every processing layer. The suggested architecture increases the robustness and dependability of conversational AI systems functioning in hostile environments, according to experimental analysis.

## **600.DEEP LEARNING – BASED SURVEILLANCE SYSTEM FOR ROOT WILT DISEASE IN COCONUT TREES AND IDENTIFICATION**

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Coconut farming is common in many regions and is an important source of income for farmers. But in recent years, diseases like root wilt have become a serious problem, as they affect the growth of the trees and reduce the overall yield. The early-stage detection of plant diseases is critical for ensuring efficient and sustainable crop management. In this work, a deep learning-based approach is proposed for coconut root wilt disease detection using a Vision Transformer (ViT) architecture. Unlike traditional Convolutional Neural Networks (CNNs), the proposed model captures global contextual features more effectively through self-attention mechanisms. A structured dataset of coconut leaf images was utilized for model training and validation to assess performance. To improve generalization, preprocessing and data augmentation techniques were integrated into the model training process. Experimental results demonstrate high classification accuracy along with improved precision and recall compared to conventional methods. Furthermore, Grad-CAM visualization is employed to provide interpretability, highlighting the infected regions in the leaf images. The proposed system demonstrates the potential of transformer-based architectures in agricultural disease detection and can assist farmers in early diagnosis and decision-making. The dataset was partitioned into training and validation subsets to ensure reliable evaluation, and model performance was assessed using standard metrics including accuracy,

precision, recall, and F1-score. When compared with basic CNN models, the transformer-based approach shows better performance in identifying complex disease patterns and understanding relationships between features in leaf images. In addition, the use of explainable AI methods helps to make the model more transparent by clearly showing which parts of the image influence its predictions, thereby improving reliability.

### **601.COOPERATIVE EDGE–CLOUD INTELLIGENCE FOR REAL-TIME ELECTRICITY THEFT DETECTION IN SMART POWER NETWORKS**

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**Objectives**—Power theft is a very vital issue in smart power distribution systems, and it brings about losses, instability in the power grids, and a risk to the life of people. Current detection systems are generally centralized, threshold costly, or place based and restrict real-time responsiveness, as well as not detecting fine behavioral patterns. **Methods**—The collaborative edge, cloud intelligence system proposed in this paper is a real-time electricity theft detection system. On the edge layer, light anomaly detection algorithm is applied on a continuous ATmega328P sensing unit that continuously monitors the voltage and current signals at the edge layer to detect suspicious consumption behavior with high responsiveness. The cloud layer consolidates long term data, creates behavioral models and detects recurrent patterns of tampering. The distributed design decreases the network overflow and increases scalability. **Findings**—The experimental results have shown that the suggested system has a higher detection speed, reduced false alarms, and better bandwidth utilization than centralized-only systems. The edge and cloud intelligence combination make smart grid large- scale settings capable of detecting the accurate and timely detection in the setting. **Novelty**—This system is scalable and cost-effective, (unlike traditional systems), as it combines edge-based lightweight detection and cloud-based

behavioral modeling. It offers an active monitoring system that enhances grid resilience and enforces real-time security in the current smart electricity systems.

## **602.PERSONALIZED VOICE CLONING FOR LARYNGECTOMY PATIENT**

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The patients who have undergone the surgery of laryngectomy cannot speak as their larynx is removed. It has impacted their communication process in a significant way. The tools used in their communication process, such as electrolarynx and Text-to-Speech, can only produce robot voices. They cannot produce natural voices. The objective of the paper is to create a voice cloning system using the XTTS V2 neural network so that natural voices can be produced. It can produce voices in real time, which will impact their communication process in a significant way.

## **603.DEEP LEARNING-BASED AREA SEGMENTATION USING SWIN TRANSFORMER AND U- NET INTEGRATED WITH WEB APPLICATION**

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This study project focuses on the exploration and practical implementation of a hybrid deep learning model that combines the Swin Transformer and U-Net architectures for field area segmentation tasks. The main goal is to examine the integrated model's operation, training dynamics, and performance behavior, highlighting its capacity to accurately segment data by capturing both local and global contextual information. With evaluation criteria including Intersection over Union (IoU) and pixel accuracy, the model is trained on a carefully selected dataset of field photos using Google Colab. To enable real-world usability, the trained model is deployed within a web-based application developed using Flask, HTML, and CSS. The platform features user authentication (registration and login) and provides an intuitive interface for uploading field images and receiving segmented outputs in real-time. This integration demonstrates a full-stack development workflow, combining model training, evaluation, and deployment. By bridging deep learning techniques with practical web deployment, this

project highlights the architectural advantages, training dynamics, and operational challenges of contemporary AI systems in real-world agricultural and remote sensing environments.

#### **604.DEVELOPMENT AND CHARACTERIZATION OF PLA–NHA–MG COMPOSITES FOR ENHANCED BIOACTIVE PERFORMANCE**

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PLA is a biodegradable and biocompatible polymer widely used in biomedical applications such as bone implants, scaffolds, and tissue engineering materials. However, the low mechanical strength and limited bioactivity of pure PLA restrict its use in load-bearing applications. To overcome these limitations, nano-hydroxyapatite (nHA) and magnesium (Mg) are incorporated into the PLA matrix to enhance its properties. These additives improve bioactivity by mimicking the mineral composition of natural bone, while also increasing biodegradability and overall material performance. The aim of this research was to develop a new composite material by combining PLA with nHA and Mg in different formulations and evaluating their structural and thermal characteristics. The composite specimens were fabricated using a customized die designed according to ASTM standards. To analyze the material properties, characterization techniques such as Differential Scanning Calorimetry (DSC), Fourier Transform Infrared Spectroscopy (FTIR), and X-ray Diffraction (XRD) were employed. These techniques were used to study thermal behavior, chemical bonding, and crystalline structure of the developed composites. The results indicated improved structural and thermal properties, suggesting that PLA/nHA/Mg composites have strong potential for biomedical implant and orthopedic applications.

#### **605.SMART CAREER GUIDANCE AND LEARNING PATH ADVISOR**

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Not many people understand how hard it is for students in Tamil Nadu who are aiming to study engineering to choose the right path. With TNEA rules getting more complicated, dozens of colleges offering different things, and jobs changing quickly, making decisions becomes really tricky. Traditional advice sessions are often too general, not considering what fits each student's unique situation. That's where Smart Career Advisor comes in. Think of it like a smart tool that uses AI to analyze real-time data, check skills, and understand behavior patterns. It uses Holland's RIASEC model to categorize personalities into six types and matches them with engineering fields that might suit them best. There's also a logic quiz to test problem-solving and puzzle-solving abilities. When predicting the chances of getting into a college, a smart model based on past TNEA data is almost 92% accurate, with 88% reliability, and it correctly identifies every successful case without missing any. It factors in scores, seat types, and realistic wish lists. One of the ways it helps is by listing real scholarships — over eighteen confirmed options. Salary details are paired with the names of companies, supported by AICTE data. Instead of making random choices, students follow structured routes with fifty-plus classes spread across nine types of engineering work. Progress is shown in different ways — not just through grades but also through streaks and evolving goals. Built with Flask and SQLite, it's not flashy, but the website feels dynamic and responsive. The guidance evolves as students do, shaped by data and designed for scalability and long-term use. The choices after school are like how machines learn patterns. Not just any method works when matching students to career interests. One method uses a forest of decisions rather than single guesses. People choose careers based on what they enjoy doing. Admission processes in Tamil Nadu shape who ends up where. Learning paths adjust themselves without copying others. Smarter schools mean systems that respond like teachers would. Numbers guide choices, but emotions and feelings also play a role.

## **606.DEEP SPIKING U-NET WITH MULTITHRESHOLD ENCODING FOR ENERGY-EFFICIENT SAR CHANGE DETECTION**

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Synthetic Aperture Radar (SAR) based change detection is widely used in remote sensing applications such as disaster monitoring, environmental analysis, and infrastructure surveillance. Despite the effectiveness of deep learning models such as Convolutional Neural Networks (CNNs), their high computational complexity and energy consumption limit their deployment in real-time and resource-constrained environments. This paper presents a Deep Spiking U-Net architecture with multithreshold encoding for efficient SAR change detection. The proposed approach leverages the event-driven computation of Spiking Neural Networks (SNNs) to significantly reduce redundant operations while preserving critical spatial features. A multithreshold encoding strategy is introduced to improve spike representation by capturing multiple intensity levels in SAR difference images. The proposed system is evaluated on benchmark SAR datasets, where it demonstrates competitive performance compared to conventional U-Net models while achieving improved energy efficiency. The results indicate that the integration of spiking mechanisms with multilevel encoding provides a promising direction for low-power remote sensing applications.

## **607.DESIGN AND IMPLEMENTATION OF A MULTI-PROTOCOL SERIAL INTERFACE FOR UART, SPI AND I 2 C WITH CONTROLLER AND BRIDGE MODES**

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In the field of digital electronics, components such as microcontrollers, analog to digital converters, processors, display and memory units use serial communication for data exchange between them. The most common and reliable protocols are Universal Asynchronous Receiver Transmitter (UART), Serial Peripheral Interface (SPI), and Inter Integrated Circuit (I<sup>2</sup>C). But these protocols have their own clocking structure and data framing. They don't have direct operability between them. So, this paper suggests a Multi-Protocol Serial Interface (MPSI) that is built using Hardware Description Language (HDL) and implemented by Cadence tools. This MPSI uses a 3-bit Mode Select (MSEL) signal to work either in controller or in bridge modes. In controller modes, the interface receives parallel input data and converts that data to any of these protocols. In bridge mode, the interface takes data from received protocol and transmits it in the chosen protocol. Only UART to SPI, UART to I<sup>2</sup>C, SPI to UART and SPI to I<sup>2</sup>C bridge conversions are supported in this design. To select these modes, MSEL signal is changed by using a push button for quick transition. It eliminates the need for microcontroller intervention by making conversion in dedicated hardware entirely. Therefore, this design offers a versatile solution such as less processing power usage and more system efficiency for modern embedded and system on chip applications.

## **608.COVERT COMMUNICATION USING AUDIO STEGANOGRAPHY IN MILITARY APPLICATIONS**

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In modern military and intelligence environments, secure communication is crucial not only for protecting transmitted information but also for concealing the existence of communication itself, especially in highly sensitive and mission-critical scenarios. Although conventional encryption methods ensure data confidentiality, the presence of encrypted information can still draw attention and increase the risk of interception or disruption by adversaries. To overcome this limitation, covert communication techniques such as audio steganography are employed, where sensitive information is embedded within ordinary audio signals so that transmission appears natural and unnoticeable. This work proposes a secure and reliable covert communication system based on audio steganography. The framework integrates Advanced Encryption Standard (AES) encryption to secure the confidential message and Reed–Solomon error correction coding to enhance reliability during transmission, even under challenging communication conditions. To preserve audio quality and maintain imperceptibility, Mel Frequency Cepstral Coefficients (MFCC) are extracted from the cover audio and analyzed using a Long Short-Term Memory (LSTM) model to identify optimal regions for embedding hidden data efficiently. Furthermore, a hybrid embedding approach combining Least Significant Bit (LSB) substitution with phase coding is implemented to balance high data capacity and robustness against noise, compression, and signal distortions. Experimental evaluation shows that the system can successfully embed and recover secret messages without noticeable degradation in audio quality, demonstrating its practical applicability. Waveform analysis also indicates that the generated stego audio closely resembles the original cover signal, ensuring imperceptibility and reliable data recovery.

## **609.SMART CLASSROOM MONITORING: EMOTION DETECTION AND ATTENDANCE SYSTEM**

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This paper presents a smart classroom monitoring system that integrates real-time facial emotion recognition with automated attendance tracking using computer vision and deep learning techniques. The system captures facial data from live webcam input or uploaded images, performs face detection, and processes the detected faces using an EfficientNet-based convolutional neural network to classify seven emotional states: angry, disgust, fear, happy, neutral, sad, and surprise. In addition to emotion recognition, the system incorporates an attendance module that automatically identifies and records student presence using facial recognition, thereby eliminating manual intervention. The model is trained on the FER2013 dataset using supervised learning, with preprocessing steps including face detection, cropping, resizing, and normalization. The trained model is deployed within a Flask-based framework to enable real-time inference. Furthermore, explainable artificial intelligence techniques are integrated to improve interpretability by highlighting the facial regions that influence model predictions. The system achieves a validation accuracy of 74.52% and a test accuracy of 67.74%, with performance variations attributed to real-world factors such as lighting conditions and pose variations. Overall, the proposed system provides a unified and scalable solution for classroom analytics by combining emotion recognition, automated attendance, and explainability, making it suitable for real-time educational applications.

## **610.DEEP Q-LEARNING FRAMEWORK FOR DYNAMIC SPECTRUM ACCESS IN COGNITIVE RADIO NETWORKS**

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Dynamic Spectrum Access (DSA) is a key solution [3] to address spectrum scarcity in modern wireless communication systems by allowing unlicensed (secondary) users to opportunistically access unused

licensed bands without interfering with licensed (primary) users. This project presents a real-time multi-agent Deep Q-Learning (DQL) framework designed for efficient spectrum allocation in cognitive radio networks. The system enables multiple agents to learn optimal channel selection policies through interaction with a simulated environment that models primary user activity, channel fading, and detection probabilities. A Dueling Deep Q-Network (Dueling DQN) architecture [8] is employed to separate state-value and advantage functions, improving learning stability and convergence speed. To facilitate monitoring and evaluation, a Flask-based web dashboard visualizes training metrics in real time, including average rewards, collision statistics, and agent behaviour. The framework demonstrates the capability of reinforcement learning to autonomously optimize spectrum utilization, reduce interference, and adapt to dynamic network conditions.

### **611.NEWSCOPE AI – AN INTELLIGENT PLATFORM FOR FAKE NEWS DETECTION WITH SUMMARIZATION AND SENTIMENT ANALYSIS**

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Online news platforms have been expanding since their inception to present information more easily accessible to people than any other time period in history because these platforms have created greater opportunities for people to be fed false information. Manually checking false news does not work very well anymore. So, the study is about Newscope AI, which is basically a smart tool created to detect false news. They use ML and DL models to read articles and they tell if they are true or false, along with sentiment analysis. They use a few different models which include Logistic regression, Naive Bayes to do the simpler checks, then LSTM to do the checks with sequences, and RoBERTa, which is the transformer model that can handle the context better. Before any of the models can be run on the news article, the article is cleaned up to remove any junk text or tokens. Then it goes through these models to make a prediction. The platform also summarizes articles from actual sources using another model, keeping it short and to the point, as well as the sentiment. On the tech side, there is a FastAPI backend that processes all the requests, as well as a Streamlit frontend that provides text box to simply paste articles and get results right away. The idea of using all these models is to add transparency so users can actually see how all this is being decided, which feels important.

### **612.ANDROSENTRYX: A HYBRID ENSEMBLE AND CONVOLUTIONAL NEURAL NETWORK FRAMEWORK FOR ANDROID MALWARE DETECTION**

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Android malware has become more sophisticated and has shown characteristics of obfuscation and behavioral adaptability. As a result, conventional static and signature-based detection methods have become progressively inadequate against such threats. A new approach in improving the accuracy of malware detection has been proposed by using a hybrid combination of ensemble machine learning and deep learning techniques. In this approach, system-level runtime parameters like CPU utilization, memory access patterns, cache behavior, and execution patterns are used to capture the intrinsic characteristics of the program. This is because program characteristics cannot be easily mimicked by the malware creators. In this approach, three classical classifiers - Logistic Regression, Random Forest, and XGBoost - are unified with a 1D-CNN through a probabilistic fusion strategy. This helps in improving the accuracy by using the advantages of machine learning and deep learning techniques. In this approach, the accuracy has been found to be 98.26%. This is more than the accuracy obtained through ensemble machine learning and other deep learning techniques individually. Other parameters like precision, recall, and F1-score also support the reliability of the system.

### **613.ECOBERT PREDICTOR+: A FRAMEWORK FOR PROACTIVE CARBON EMISSION PREDICTION IN NLP MODEL TRAINING**

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Transformer-based NLP models have achieved rapid performance improvements, but at the cost of increased energy consumption and carbon emissions. Existing tools such as Eco2AI and Carbon Tracker mainly monitor emissions during or after training, offering limited support for proactive decision-making. To address this gap, this work proposes EcoBERT Predictor+, a framework for estimating carbon emissions before model training. A dataset was constructed through controlled experiments on transformer models with varying sizes and configurations. Using this data, regression-based models were developed to predict emissions based on model architecture, training parameters, and hardware characteristics. The framework also integrates an Optuna-based optimization module to identify energy-efficient training configurations with minimal performance loss. Experimental results show that the proposed approach accurately predicts emissions across diverse transformer architectures and significantly reduces carbon output while maintaining performance. EcoBERT Predictor+ enables a shift from reactive monitoring to proactive planning, supporting more sustainable AI development.

#### **614.EFFICIENT MULTI-SCALE TRANSFORMER WITH SPARSE ATTENTION FOR REAL- TIME SIGNAL DENOISING IN RESOURCE-CONSTRAINED IOT SYSTEMS**

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The aim is to produce an edge processing mechanism to improve the quality of noisy signals produced by IoT sensors. In this way, error data collection can be performed in ECG, mechanical vibration, and environmental monitoring without relying on cloud processing entities. An Arduino-based sensing node is using real-time signal acquisition. Transmits them server side over serial to the PC. The Python pipeline logs the data, then effects the denoising model Edge Former on sliding windows and visualizes the noisy and cleaned waveforms together. Edge Former is trained on a combined dataset of tabulated ECG waveforms crossed with vibration/environmental data. The model succeeds to some extent in separating useful patterns from stationary noise. Its findings yield a higher SNR and a lower error associated with reconstruction and are kept relatively compact for fast and effective edge deployment. In live demonstrations, this calls for denoising of the Arduino data and displays it alongside the raw form. This shows an immediate indication of noise suppression after the saved features remain: peaks, responses to transient disturbances. This suggests transformer-based denoising work with low-cost microcontroller hardware to produce cleaner and low-latency inputs for further health and environmental analysis.

## **615.IOT BASED SMART MIRRIOR WITH HEALTH INSIGHTS**

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The rapid growth of Internet of Things (IoT) technology has enabled the development of smart healthcare monitoring systems that allow individuals to track their health conditions in real time. Traditional health monitoring methods require manual recording and frequent hospital visits, making continuous monitoring difficult and inconvenient. To overcome these limitations, this project proposes an IoT-Based Smart Mirror with Health Insights, which integrates health monitoring sensors with a smart mirror interface to provide real-time health information in a simple and user-friendly manner. The proposed system utilizes an ESP32 microcontroller to interface with multiple sensors and enable IoT connectivity. It monitors essential health parameters such as heart rate and environmental conditions using a pulse sensor and DHT11 sensor. The collected data is processed by the ESP32 and displayed on an OLED display for immediate feedback. In this Phase-I prototype, the focus is on hardware implementation and real-time data visualization, while full smart mirror integration will be developed in future phases. To enhance system functionality, the system is integrated with the Blynk application, allowing remote monitoring of health data through a smartphone. When abnormal readings are detected, alert notifications are sent directly to the user's mobile device. Additionally, a local alert mechanism using an LED is implemented, and future enhancements will include a buzzer. The system is powered using a USB Type-C connection, ensuring stable and reliable operation. This project presents a low-cost and efficient solution for real-time health monitoring, suitable for smart home environments and personal healthcare applications. By combining IoT technology with an intuitive interface, the system supports continuous health monitoring and future smart healthcare solutions.

## **616.SMART AI PROMPT MANAGER**

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This project presents the development of an advanced Chatbot system designed to provide personalized assistance across various domains such as education and Data Structures and Algorithms (DSA). The platform integrates intelligent conversational capabilities using the OPEN AI API / GEMINI AI API, enabling context-aware interactions that offer accurate and relevant responses tailored to user needs. The system is composed of several modules including Home, Register, Login, Categories, Chatbot, and Logout, which allow users to interact with the chatbot and access categorized content based on their specific requirements. Security is a core feature of the platform, with Blockchain-based algorithms integrated into the user registration and login processes to ensure data privacy and secure interactions. The backend of the platform is powered by Python and Django, providing a robust environment for handling user requests, while SQLite is used as the database to store user data and Chatbot content. The frontend is built using HTML, CSS, and JavaScript, offering a responsive and user-friendly interface to ensure seamless user experiences. Given that the OPEN AI API / GEMINI AI API is a paid service, users are advised to be aware of its usage limitations and associated costs. This system aims to deliver secure, scalable, and intelligent Chatbot-based solutions to enhance communication and assist users in a variety of educational and technical domains. By implementing advanced security measures and

efficient user interactions, the platform strives to create a secure and engaging environment for both users and administrators.

### **617.A MACHINE LEARNING-BASED WEATHER FORECASTING SYSTEM WITH LIVE DATA ANCHORING AND UNCERTAINTY ESTIMATION**

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The classical weather forecasting models that have been created in the academic settings often work on stationary data and point forecasting, providing little information on how reliable the predictions are or how the current conditions affect the predictions. In this paper, we are describing a machine learning-based weather forecasting system that integrates learning of the patterns in the past with live information anchoring and uncertainty prediction. The proposed method combines the XGBoost Regression [2] application in temporal modelling, incorporates real time weather data via the Open-Meteo API [12] to anchor forecasts and recursive multi-step forecasting with residual-based uncertainty estimation. The architecture is made up of FastAPI backend [14] and a Streamlit frontend, creating a complete end to end deployment pipeline. The experimental testing exhibits a good performance with interpretable confidence intervals that increase forecast transparency. Consequently, the system can be easily applied to academic research as well as practical implementation. The work discusses some of the main shortcomings that are usually witnessed in the student-level forecasting projects by providing realistic interpretable and modular solution that resonates with real world operational constraints.

### **618.BRAIN STROKE HAZARD FORECAST USING DEEP LEARNING ON IMBALANCED CLINICAL DATA**

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Stroke is among the most critical neurological disorders and is responsible for a large proportion of global mortality and disability cases. Early identification of individuals who are likely to develop stroke can significantly reduce medical complications and enable preventive care. In this research, a machine learning based framework is developed to estimate stroke risk using structured healthcare data. The proposed approach utilizes the TabNet deep learning architecture, which is specifically designed for learning from tabular datasets while maintaining interpretability. The dataset used in this study contains patient attributes including demographic details, health conditions, and lifestyle indicators such as age, hypertension, heart disease, smoking status, body mass index, and glucose levels. Several preprocessing techniques are applied to improve data quality, including missing value handling, categorical encoding, and class balancing using the Synthetic Minority Oversampling Technique (SMOTE). The model is trained and evaluated using multiple performance metrics including accuracy, precision, recall, F1-score, and Area Under the ROC Curve (AUC). The trained model is integrated with a lightweight Flask based web application that enables real time stroke risk prediction. Experimental results demonstrate that the proposed model achieves reliable predictive performance and can serve as a supportive clinical decision making tool for early stroke risk assessment.

### **619.PREDICTIVE ANALYSIS OF TEEN BEHAVIOURAL INDICATORS FROM SOCIAL MEDIA TRENDS USING LOGISTIC REGRESSION**

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Social media has become a major place where teenagers display emotions and behavioral patterns. The constant exposure to the trends on the Internet and online communication affects adolescent behavior and lifestyle to a great extent. The overuse of trending content can cause minor behavioral changes that are usually overlooked until one realizes that they escalate into severe social or mental issues. The main solutions currently available are centered on the usage statistics and cannot provide insights into the risks of behavior at the earliest stage or do not have a predictive framework that would align with the techniques of data science and machine learning to analyze structured social media trends data. The proposed project will address the gap by proposing a predictive analytical framework that will analyze the trend statistics of the social media in a structured way. Such features as the frequency of engagement, interaction patterns, and involvement in online trends are mined and analyzed. The classification models used to predict teenage behavioral pattern are Logistic Regression and Decision Tree. The experimental findings show that it predicts approximately 85 percent, which is much better as compared to the conventional descriptive analysis techniques. The system offers evidence-based understanding, which is used to ensure early behavioral awareness and prompt intervention.

### **620.SEISMIC ANALYSIS OF MULTI-STORIED BUILDINGS WITH EVEN AND UNEVEN STORY HEIGHTS UNDER SYMMETRIC AND UNSYMMETRIC CONFIGURATIONS**

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Seismic behavior for 15-story reinforced-concrete frame structures was examined on a variety of configuration geometries. The two buildings included in this study were G + 15 RCC frames: One frame had a symmetrical floor plan and equal (even) story heights; the other frame had an unsymmetrical floor plan (unsymmetrical plan or irregular story heights) and was studied in ETABS 2018 using the Response Spectrum Method, per IS 1893:2016 (Zone IV). A comparison of key response characteristics, including total base shear, maximum displacement between stories, story shear and stiffness, in each direction X and Y, was conducted. The results indicated that the symmetrical, equal-height model exhibited the most beneficial seismic behavior. There is a more even distribution of drift, the torsional responses were minimal, and there is a more uniform distribution of overall stiffness and strength. The comparison of the results from the symmetric model and the unsymmetrical model showed exhibited poor responses to an earthquake. Our study found that the irregular case had increases in top-floor displacement of approximately 4-5% and increases in peak story drift of approximately 12% increases, when compared to the regular case. Thus, validating the use of response-spectrum analysis for comparative seismic evaluations of structures.

### **621.FUSIONNET-Q: A QUANTUM AND CLASSICAL DEEPLARNING MODEL FOR OIL SPILL CLASSIFICATION**

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The project is presented in the form of hybrid deep learning framework that combines classical and quantum learning techniques for accurate oil spill classification. Accidental oil discharges over ocean surfaces causes ecological damage that destroys the environmental beauty. So, it demands fast and reliable detection mechanisms. Some conventional techniques are supported unto the mark that is limited by the cost and delayed response. This proposed model introduces an advanced neural learning-based framework for identifying the oil spills patters from the Synthetic Aperture Radar (SAR) imaginary. A dataset containing 4000 SAR images, that contains the parts that are oil spill and non-oil spill categories, is used for the model. The dataset which is used is subdivided in the form of subsets that are train, validation and test. At first, learning undergoes standard preprocessing and augmentation to enhance feature recognition and reduce overfitting. The developed system employs a hybrid learning approach, where a classical convolutional neural network identifies compact spatial representations that are further integrated with quantum neural layer constructed using variational quantum circuits. The system is developed using PyTorch and PennyLane and is executed as a real-time application through a Fast API-based backend integrated with browser-based frontend. After the performance evaluation on the dataset, confirms that the system achieves robust classification accuracy and effectively separating oil spills that are in the dataset images.

### **622.CMS: A CENTRALIZED WEB-BASED ERP FRAMEWORK FOR ACADEMIC ADMINISTRATION**

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Schools need Enterprise Resource Planning (ERP) solutions these days because the way they run their schools, teach, and do business is getting more and more complicated. Most college administration systems that are used today are very similar, only work with certain apps, and are hard to change for schools that do things differently. The research in this paper presents a significant, role-based, modular ERP framework model designed for implementation in educational institutions. This structure divides important institutional tasks like managing users, departments, teachers, and alerts into smaller, connected parts. A role-based access control system lets administrators, academics, and departments talk to each other. This structure can be used, and applied to any subject, unlike other web-based educational portals. This means that it can be used by schools, colleges, training centers, and other groups like that. A prototype implementation shows how the framework works and how it could be changed or added to without breaking the main system. The proposed ERP design provides a basis for additional exploration of extensive digital systems and flexible academic frameworks within educational institutions and diverse enterprises.[title, text, heads, etc.]. \*CRITICAL: Do Not Use Symbols, Special Characters, Footnotes, or Math in Paper Title or Abstract.

## **623.HEART DISEASE PREDICTION USING ARTIFICIAL NEURAL NETWORK**

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The heart disease data set is split into training and testing datasets. The ANN's design comprises an input layer, one or more hidden layers, and an output layer. The neural network undergoes training with heart disease data. This process helps the network learn the connection between the different medical features and heart disease risk. Once the ANN completes training, it's tested with the testing dataset.

#### **624. AN EXPLAINABLE COST-SENSITIVE ENSEMBLE FRAMEWORK FOR IMBALANCED CREDIT CARD FRAUD DETECTION**

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Financial transactions made easy through digital and online payments have been plagued by credit card fraudsters. Credit card fraud amounts to billions of dollars lost each year [1]. One challenge encountered when training Machine Learning models to detect fraud is skewed datasets. Real world datasets suffer from class imbalance as there are more genuine transactions than fraudulent ones [2]. Many ML models trained on imbalanced datasets are unable to predict minority classes consistently. Many successful classification models are complex and known as black-box models, lacking transparency required for audits and compliance. This paper proposes a framework which combines cost sensitive learning, SMOTE and an ensemble of Random Forest and XGBoost classifiers for credit card fraud detection. The method also explains predictions using SHAP feature importance scores. We tested our framework on ULB credit card dataset which contains 284,807 transactions, of which 0.172% are fraud. We achieved 99.91% accuracy, 94.12% recall in detecting frauds and F1-score of 0.889 for minority class, as well as near-perfect separability on ROC-AUC. Our framework shows that ensemble learning and Explainable AI can work hand-in-hand to improve credit card fraud detection on skewed datasets [3].

#### **625. SEGMENTATION BASED 3D RECONSTRUCTION AND FUSION OF CT AND MRI MEDICAL IMAGES**

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Three-dimensional (3D) reconstruction and fusion of brain Computed Tomography (CT) and Magnetic Resonance imaging (MRI) images using segmentation is important to accurately visualize the neuroanatomy of the brain and analyze it clinically. The CT images of the brain give high resolution data about hard structures like skull and hemorrhages whereas the MRI gives a better contrast of the soft tissues in the brain with reference to the normal tissue. This paper introduces a unified framework of the combination of noise suppression through the use of median filtering, multi-level tissue segmentation using adaptive Otsu thresholding and morphological operations, registration between MRI and CT, which is a rigid approach using mutual information (MI) maximization, intensity normalization, isosurface-based 3D surface reconstruction through the use of Gaussian smoothing and polygon decimation and an interactive real-time visualization environment. The framework was confirmed using three independent experimental Patients with the best-case results of the Mutual Information of 1.2362, Dice similarity coefficient of 0.8485, and the Normalized Cross-Correlation of 0.7691, PSNR of 59.25 dB, and Jaccard Index of 0.7368. Comparative analysis showed high performance as compared to deep deformable, unsupervised and meta-heuristic registration baselines.

The given solution improves the brain structure interpretation and helps in clinical diagnosis, surgical planning, and neurological studies.

## **626.DSP-OPTIMIZED VLF TRANSCEIVER FOR COMPACT, RESILIENT TEXT COMMUNICATION**

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The state-of-the-art emergency communication system has critical failures in disaster situations when the traditional cellular network and GPS system are not accessible due to tower destruction, power failures, or network saturation. This paper describes the AI-Assisted Emergency Communication System with low-cost ESP32-based IoT mesh nodes optimized with machine learning for predictive routing in infrastructure-less environments. The proposed system has a three-layer architecture, including a physical layer based on the ESP-NOW protocol for communication between peers, an intelligence layer that uses Random Forest models for predicting the wireless link quality with 82.4% accuracy, and an application layer that provides proactive routing with Dijkstra's algorithm optimized by AI predictions. In contrast to reactive protocols that act only after a link failure, our system makes predictions about RSSI degradation 8–10 seconds in advance, allowing for proactive rerouting before packet loss. Experimental results on four different use cases show a 28% improvement in packet delivery ratio for node mobility (87% vs 68% baseline), 47% faster recovery time for node failures (8s vs 15s), and 19% improvement in distance variation scenarios. Our system provides 90%+ cost savings over commercial solutions (\$12 vs \$180–250 per node) while maintaining collision-free communication and real-time routing updates at 45ms latency. Statistical analysis verifies the significance of results ( $p = 0.003$ , Cohen's  $d = 0.87$ ).

## **627.OPTIMIZING GLOBAL SUPPLY CHAIN AND LOGISTICS USING DATA DRIVEN APPROACHES FOR COST REDUCTION AND RISK MANAGEMENT**

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Today's global supply chains are becoming more complicated than ever. Companies working across different regions face challenges like political tensions, sudden changes in customer demand, shortages of raw materials, and disruptions in transportation. Balancing cost efficiency, reliable delivery, and clear visibility into risks all at once is tough. Traditional ways of managing supply chains often depend on fixed plans, past data, and manual decisions, which makes it hard to quickly respond to fast-changing market conditions. This leads to delays, higher costs, inventory problems, and a greater chance that one disruption can ripple through the whole system. Because suppliers, manufacturers, logistics providers, and distributors are so interconnected, a problem in one place—like trade restrictions, natural disasters, pandemics, or infrastructure breakdowns—can quickly impact the entire supply chain, causing serious operational and financial issues. On top of that, limited transparency and a lack of real-time information make it difficult for companies to spot risks early, consider different options, and act quickly to fix problems. Customers today expect faster deliveries, better service, and more environmentally friendly practices, which adds even more pressure on supply chains to be efficient and sustainable. Regulations, limits on carbon emissions, and ethical sourcing rules are also making supply chain planning and execution more complex.

## **628.AI -DRIVEN PUBLIC HEALTH CHATBOT FOR DISEASE AWARENESS AND ASSISTANCE**

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The demand for healthcare services that people can actually use and that do not cost much is getting bigger and bigger. Because of this people are starting to use intelligence or AI for short to make healthcare better. One way they are doing this is with chatbots. These chatbots can give people some idea of what's wrong with them and help them decide what to do. This paper is about a chatbot that uses natural language processing or NLP and machine learning to understand what people are saying and to give them good advice. The chatbot also uses knowledge about medicine to make sure the advice it gives is correct. The people who made the chatbot used a way of combining rules about medicine with deep learning to make the chatbot more accurate and easier to understand. They also made sure the chatbot is easy to use and that it does what it is supposed to do. They thought about the problems that might come up and how to keep people's private information safe. The results of their tests show that the chatbot can really help people figure out what is wrong with them and get them to go see a doctor when they need to. It can also help people stop using information they find online and get them more involved in their own healthcare. This research is important because it can help make agents, like chatbots that people can really use and trust. The keywords, for this research are Artificial Intelligence, Medical Chatbot, Natural Language Processing, Machine Learning, Healthcare Informatics, Telemedicine, Conversational Agents and Data Privacy.

## **629.MACHINE LEARNING-BASED RAINFALL PREDICTION USING FEATURE SELECTION AND HYBRID MODELS FOR IMPROVED FORECAST ACCURACY**

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Rainfall prediction plays a crucial role in raising awareness about potential weather hazards and enabling individuals and organizations to take proactive measures for safety and preparedness. This study aims to utilize deep learning algorithms to accurately predict rainfall, considering the significant impact of scarcity or extreme rainfall on both rural and urban life. The complex nature of rainfall, influenced by various atmospheric and meteorological factors, makes it a challenging phenomenon to forecast. This research employs data preprocessing techniques including standard scaling and stratified sampling, along with a hybrid deep learning framework that combines an Artificial Neural Network (ANN) and a Long Short-Term Memory (LSTM) network. The dataset comprises 55,996 weather observations with eight carefully selected meteorological features: minimum temperature, maximum temperature, rainfall, humidity, atmospheric pressure, wind speed, wind gust speed, and cloud cover. The ANN processes flat feature vectors through fully- connected layers while the LSTM processes the same features as a reshaped sequential tensor; the sigmoid output probabilities of both models are averaged to yield a final hybrid prediction. The hybrid model outperforms both standalone ANN and standalone LSTM architectures across all evaluation metrics including accuracy, precision, recall, and F1-score. Furthermore, the trained models are deployed within a Flask-based web application integrated with a live WeatherAPI service, enabling real-time city-level rainfall forecasting for users across more than 50 cities globally. Overall, this research demonstrates the effectiveness of hybrid deep learning techniques in predicting rainfall using a compact yet highly discriminative set of meteorological features.

## **630.CODE SENSE: A RETRIEVAL-AUGMENTED FRAMEWORK FOR INTELLIGENT CODE UNDERSTANDING**

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Software development in modern times involves large volumes of multilingual and constantly changing source codes. It is very challenging to interpret these codes due to limited documentation and complex relationships. In an effort to address these problems, this paper proposes a multilingual code retrieval and understanding framework referred to as Code Sense. This framework employs a Retrieval-Augmented Generation (RAG) approach. The proposed system automatically processes source codes stored in repositories using the Git version control system. It detects the programming languages and employs structured chunking methods to extract significant code units such as functions, classes, and methods while preserving context. The extracted code units are then indexed for efficient retrieval through a combined method. The combined method contains FAISS-based dense vector similarity and BM25 ranking. The proposed framework retrieves significant code units during query time and grounds them in a Gemini large language model. This enables accurate and clear responses with precise file path and line range references. The proposed system provides a noticeable change in source code analysis and querying. The proposed system achieves Precision@5=0.6267, NDCG@5=0.8730, MRR=0.9667, and MAP=0.6127. The proposed system outperforms the fallback chunking approach by up to 161% in Precision@5. The proposed system grounds responses in retrieved source code content, and the results emphasize the significance of structural chunk sizes in source code understanding at the repository level.

### **631.WEB-INTEGRATED RAG SYSTEM FOR REAL-TIME AI RESPONSES**

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Large Language Models (LLMs) have made promising advances in natural language comprehension and text generation, but they suffer from knowledge staleness and hallucinations because they rely solely on static training data. To address these limitations, this paper presents a Web-Integrated AI Response System based on Retrieval-Augmented Generation (RAG), which combines real-time web content retrieval with intelligent response generation. The proposed system accesses live web sources via web scraping and search APIs, followed by preprocessing and hybrid retrieval. The retrieved content is then supplied to a Large Language Model as contextual input to produce accurate, coherent, and context-sensitive responses. A React-based frontend provides an interactive user interface, while a Flask-based backend handles query processing, retrieval, and generation. Empirical evaluation demonstrates that the proposed RAG-based system achieves higher response accuracy, lower hallucination rates, and improved relevance compared to standalone LLM-based systems. The system is applicable to research assistance, customer support, and intelligent information retrieval.

### **632.SUSTAINABLE MULTI-CLOUD SCHEDULING USING MARL AND LSTM-BASED ENERGY FORECASTING**

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The rapid expansion of cloud computing infrastructures has led to substantial increases in energy consumption and carbon emissions, posing significant environmental challenges. While renewable energy integration into distributed data centers offers a sustainable solution, its intermittent and geographically variable nature makes energy-aware workload scheduling a complex optimization problem. In this paper, we propose an intelligent and carbon-aware multi-cloud scheduling framework that integrates Long Short-Term Memory (LSTM)-based renewable energy forecasting with Multi-Agent Reinforcement Learning (MARL) for sustainable workflow execution. The LSTM model captures temporal dependencies in historical electricity grid data to predict future renewable energy availability and carbon intensity. These predictions are incorporated into a distributed MARL-based scheduler, where each cloud data center acts as an autonomous agent learning optimal task allocation policies through a carbon-aware reward mechanism. A hierarchical decision framework is designed to jointly consider energy availability, server utilization, and workflow constraints. The proposed system is evaluated in a simulated multi-cloud environment and compared with traditional baseline scheduling approaches such as random and energy-unaware allocation. Experimental results demonstrate improved renewable energy utilization, reduced brown energy consumption, and significant carbon emission reduction. Furthermore, an interactive dashboard provides transparent monitoring of energy usage and environmental impact, supporting sustainable cloud management.

### **633.DEEPFACECRAFT: REALISTIC FACE SYNTHESIS WITH CONVOLUTIONAL GANS**

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Artificial intelligence for the generation of realistic images of human faces has attracted considerable attention due to its broad range of applications in computer vision, digital media, virtual reality, security systems, and data augmentation. Standard image generation methods lack the capability to model complex facial structures and high-dimensional feature distributions. A DCGAN-based framework has been developed for synthesizing high- quality images of the human face. An adversarial learning approach in the proposed framework consists of a generator network for generating fake images of human faces from random noise vectors and a discriminator network for distinguishing real from fake images. The proposed framework models spatial hierarchies and facial features effectively through convolutional layers in both generator and discriminator networks. The proposed framework is trained on the CelebA dataset, which contains enough images to learn each type of attribute such as age, gender, and expression. All experimental results support the proposed DCGAN framework for generating realistic and diverse images of the human face with enhanced stability and performance compared to the conventional GAN models.

#### **634.EFFICIENTNET-BASED DEEP LEARNING FRAMEWORK FOR SKIN CANCER DETECTION FROM SMARTPHONE IMAGES**

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Spotting skin cancer early boosts chances a lot, especially with the serious kind called melanoma. Still, plenty of people can't get proper skin checks because they live too far away or face money troubles and broken systems. A system built around smart software now uses phone pictures to help find warning signs sooner. One way this tool works involves a smart algorithm built around EfficientNetB0 to tell harmless spots apart from dangerous ones on the skin. Instead of guessing, it studies patterns found in open collections like HAM10000 and ISIC - images showing things such as uneven shapes, jagged edges, or shifts in pigmentation. With those examples, it learns what signs matter most when spotting trouble early. Once ready, the brain behind the app gets shrunk down carefully so phones can run it directly - no web needed. Because everything stays local, personal data never leaves the device, keeping checks private by design. From tests, the model shows skill at spotting harmful skin changes, suggesting possible use in first-step checks. Though meant to stand beside doctors rather than take their place, it helps people notice warning signs and reach out for care sooner. In total, merging smart algorithms with phone access opens paths to faster spotting of dangerous growths.

#### **635.PROMPTGUARD – ADAPTIVE LLM PROMPT OPTIMIZATION PLATFORM**

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Large Language Models (LLMs) generate incorrect and prejudiced and unsafe outputs because their prompts remain unoptimized. The study introduces PromptGuard which functions as an online platform that adapts to automatic prompt improvement and security measures for multiple LLMs through its API interface. The system uses simulated reinforcement learning together with reward scoring and beam search and evaluation pipelines to improve reliability and safety and system transparency while decreasing hallucinations and increasing response consistency.

### **636. AN INTELLIGENT INTERNSHIP AND INDUSTRIAL TRAINING MANAGEMENT SYSTEM WITH PLACEMENT PREDICTION USING KOTLIN MVC, KOTLIN JETPACK COMPOSE, ML, AND FIREBASE**

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Academic institutions and industries face challenges in efficiently managing internship programs, training records, and placement workflows due to manual processes, fragmented communication, and disconnected data. To address this, we propose an Intelligent Internship and Industrial Training Management System with Placement Prediction using Kotlin (Android), Firebase, and Machine Learning. The system streamlines the internship lifecycle from application and approval to tracking and evaluation through a unified mobile platform, offering a superior user experience and accessibility compared to current placement automation software. Role-based access ensures relevant interaction for students, mentors, coordinators, and administrators. Utilizing Kotlin MVC (Model View Controller) architecture to interact with the Firebase database, the system employs machine learning algorithms to analyze user data and generate intelligent insights, enhancing application functionality and automation. This internship and industrial training project provide hands-on exposure to modern mobile application development, backend services, cloud integration, and applied machine learning.

### **637.A BLOCKCHAIN-BASED SYSTEM FOR SECURE CERTIFICATE AUTHENTICATION AND VERIFICATION**

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Managing digital certificates through centralized databases has worked for years, but the failure points are well known: a single compromised system can allow silent edits, delayed revocations, or fraudulent credentials that pass manual checks. We present a blockchain-based certificate authentication and verification system built on Solana and IPFS, where issuers encrypt certificate files with AES-256 GCM, generate SHA-256 hashes, upload the encrypted documents to IPFS, and record only the hashes and content identifiers on-chain through smart contracts that restrict who can issue. Verifiers submit a certificate; the system runs a hash comparison against the blockchain-anchored record and returns a result — no issuer contact needed. Trust is spread across validator nodes rather than stored in one database, which makes forgery harder to conceal and self-service verification practical for universities, government agencies, and organizations that regularly deal with credential checks at scale.

### **638.APPLICATIONS OF MACHINE LEARNING AND DEEP LEARNING ALGORITHMS FOR IMAGE RECOGNITION**

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Image recognition has become a key area in computer vision. It enables automated analysis of visual data for various applications. This paper offers a detailed look at Machine Learning and Deep Learning algorithms, including Support Vector Machines, Random Forests, and Convolutional Neural Networks. We explain the full workflow of modern image recognition systems, compare traditional methods with the latest deep learning techniques, and showcase real-world applications in healthcare, security, retail, and autonomous systems. Our study highlights significant challenges like data bias, privacy issues, computational complexity, and interpretability. Lastly, we discuss new research directions such as Explainable Artificial Intelligence, efficient models, edge computing, and Internet of Things applications. The paper wraps up with practical recommendations for users.

### **639.HUMAN-AI INTEGRATION: ADAPTIVE FRAMEWORKS FOR SYNERGISTIC TEAMWORK AND INFORMED DECISION-MAKING IN HIGH- STAKES ENVIRONMENTS**

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With the ever-increasing prevalence of AI in high-stakes applications, decision fatigue is becoming a significant problem among humans involved in decision-making processes, necessitating an innovative approach towards human-AI collaboration. In this research work, we introduce a new Closed-Loop Human-AI Teaming architecture, the Adaptive Decision Allocation Framework (ADAF). The key features of ADAF are a closed loop between a Cognitive State Monitor (CSM) combining EEG, GSR, and HRV measurements with a Dynamic Task Classifier, and a fuzzy-logic-based Adaptive Allocation Controller (AAC) employing a Mamdani inference engine. Using simulations across 45,000 episodes over three critical domains—ICU triage, algorithmic trading, and disaster response coordination—we find that ADAF decreases human operator cognitive load by 34.7%, increases overall decision accuracy by 12.4 percentage points compared to a human-AI baseline, and decreases response latency to critical events by 57.3% relative to standalone human performance. In user studies (n = 96 domain experts), we find that ADAF provides superior trust calibration, situational awareness, and load offloading for humans.

#### **640.EDGE AI- ENABLED EMBEDDED HELMET SYSTEM FOR REAL-TIME TUNNEL AND MINING WORKER SAFETY MONITORING**

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The edge AI-enabled embedded helmet system proposed in this paper is aimed at improvement of safety monitoring system that integrates embedded system, wireless node-to-node communication, and edge AI for real time hazard detection and proactive risk management. The proposed system is to develop a smart helmet for the safety purpose of under mining workers which includes multiple sensors to ensuring better safety and monitoring at the worksite. The data that has been gathered from the sensors is sent to both the helmet and website using edge AI. The transmitter node collects information from multiple helmets to access overall safety. This method ensures continuous monitoring, immediate hazard alerts, efficient communication, and improved worker protection in high-risk underground environments.

#### **641.EARLY RETINOBLASTOMA DETECTION USING YOLOV8 AND MEDICAL RAG**

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It is critical to have an early diagnosis of retinoblastoma, which is a rare, aggressive cancer of the eye; this will help prevent loss of vision and/or death. This study proposes a novel AI-based approach to the early detection of retinoblastoma using YOLOv8, MedGPT, and RAG. YOLOv8 provides detection of problematic areas such as leukocoria from eye imaging data. MedGPT assists with the interpretation of findings for a diagnosis; RAG also supports the interpretability of results by allowing for the grounding of its predictions within current medical research. Through experimental work, this study provides evidence that the proposed system can detect retinoblastoma accurately and with interpretability, including within resource-constrained settings.

#### **642.A NOVEL APPROACH TO CONCEALED COMMUNICATION VIA IMAGE ENCRYPTION AND KEY GENERATION**

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This paper gives an overview of a secure web based image steganography system that combines the cryptography confidentiality with spatial domain data hiding for the protected message transmission. The framework that they propose for accomplishing this involves using both a Flask-based application layer and ChaCha20 symmetric encryption and pseudo-random LSB embedding to hide secret textual data in digital images. User authentication, session management and operation logging are to bring the control of access and traceability. Prior to entering the crypto stream, the secret message is encrypted with a key derived from the password and converted into a binary stream and prefixed with a fixed-length header containing the size of the payload. The bits of the encryption are then embedded into randomly chosen pixel-channel locations based on a deterministic seed generated from the user password, so that this extraction is reproducible, but the seed value cannot be taken and used to restore the password. On the receiver end, the same password recreates the embedding pattern to extract, reconstruct and decrypt the hidden message. Image quality degradation is quantitatively assessed with the help of peak signal-to-noise ratio, and it shows little perceptual effects on the stage-images. Although discrete wavelet transform utilities have been included to support possible frequency domain extensions, the present implementation is for spatial domain robustness and simplicity. The results show that the proposed system effectively balances security, imperceptibility and usability; hence it is applicable for secure communication in the academic and controlled application scenarios. Keywords - Image steganography ChaCha20 encryption Least significant bit embedding Secure data hiding Flask web application Password-based key derivation Pseudo- random embedding Peak signal-to-noise ratio SQLite database Information security

### **643.COMPARATIVE COST ANALYSIS OF CONVENTIONAL BUILDING MATERIALS AND SMART LOW-COST ALTERNATIVES FOR G+1 RESIDENTIAL BUILDING**

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The construction industry in India is experiencing a rapid increase in material and labor costs, making conventional construction methods increasingly expensive and less sustainable. Traditional materials such as clay bricks, Ordinary Portland Cement (OPC), steel, and river sand contribute not only to higher construction costs but also to significant environmental degradation due to high energy consumption and carbon emissions. In this context, the use of smart and low-cost construction materials has emerged as an effective alternative for achieving economical and sustainable building solutions. This study presents a comparative analysis of cost estimation between conventional building materials and smart/green construction materials for a G+1 residential building. The analysis is carried out using the central line method of estimation, ensuring consistent material quantities for both cases. Parameters such as cost, material consumption, dead load, construction time, labor requirement, and sustainability are evaluated. The results indicate that the use of smart materials such as AAC blocks, EPS panels, and gypsum plastering reduces the overall construction cost by approximately 18.44%. Additionally, these materials contribute to reduced structural load, faster construction, and improved energy efficiency. The study concludes that smart and low-cost materials provide a viable solution for affordable housing while promoting sustainable construction practices

#### **644.ENHANCING ROAD SAFETY WITH V2V COMMUNICATION USING IOT**

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Accidents on the road are the major causes of injuries and deaths worldwide, and this is usually caused by late detection and lack of communication between vehicles. In this regard, this project “Enhancing Road Safety with V2V Communication Using IoT” aims to provide a system that monitors the status of each vehicle and alerts other vehicles to avoid accidents. This system has various sensors that measure the status of each vehicle. It has an ultrasonic sensor to measure the distance between vehicles, MPU6050 to measure sudden acceleration or overtaking of a vehicle, a limit switch to measure the braking of a vehicle, fire sensor, alcohol sensor, and an emergency button to send an alert immediately. It also has LoRa-based V2V communication to send data to other vehicles, display it on an LCD screen, send it to a Telegram bot with GPS location, and save it to the cloud for monitoring.

## **645.DESIGN AND SIMULATION OF A SCALABLE BACKEND ARCHITECTURE FOR REAL TIME PUBLIC TRANSPORT TRACKING**

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Urban public transportation systems in developing nations suffer from deeply embedded information asymmetry: transit operators know where their buses are, but passengers do not. Existing systems either rely on costly stop-level hardware, depend on third-party mapping APIs whose pricing and availability are outside the operator's control, or remain confined to static timetables that bear little relation to actual service conditions. This paper presents the design and simulation of a scalable backend architecture for real-time public transport tracking, implemented using an asynchronous RESTful API framework built on FastAPI and PostgreSQL. The architecture delivers live GPS bus location data, route assignment management, and Estimated Time of Arrival computations without any dependency on external mapping services or stop-level display infrastructure. Distance is computed using the Haversine geodesic formula, and arrival times are derived from a rolling average of recent GPS speed readings. Speed values are clamped between 5 km/h, the accepted GPS multipath drift threshold for stationary vehicles, and 80 km/h, the legally mandated speed governor ceiling for commercial passenger vehicles in India, to eliminate physically implausible readings from the computation. A TTL-based in-memory caching layer achieves approximately 85 percent elimination of redundant database queries under concurrent access, maintaining median API response latencies below 50 milliseconds for cached endpoints. Computational consistency testing confirms that system-reported ETA values deviate less than 5 percent from analytically derived Haversine reference calculations. The architecture is validated through structured simulation and is positioned as a production-ready server-side foundation for real-world deployment with physical GPS transmitting hardware.

## **646. SYSTEM ANALYSIS OF 8-CHANNEL WDM OPTICAL FIBER LINK UNDERGOING FIBER NONLINEARITIES WITH MACHINE LEARNING-BASED BER PREDICTION**

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Wavelength division multiplexing (WDM), an important way used to create high-capacity optical communication networks, is greatly affected by nonlinear properties in fiber optics, such as self-phase modulation (SPM), cross-phase modulation (XPM), and four-wave mixing (FWM). This study produces and analyzes an 8-channel WDM optical fiber link under nonlinear conditions of operation in order to look into the effects of crucial parameters including optical input power, spacing of channel, and transmission distance on system performance. Performance metrics such as Q-Factor and Bit Error Rate (BER) are used to assess signal quality under different operating conditions. Adding onto the simulation-based analysis, a machine learning-based regression model is trained for BER prediction using system parameters as input features. Multiple models are assessed to learn the nonlinear connection between system variables and assessment metrics. The proposed combined simulation and data-driven approach gives an efficient framework for system analysis and the design and optimization of WDM systems operating under nonlinear functionalities.

#### **647.VOICEGENIE: AI-POWERED CALLING AGENT WITH SMART SALES ASSISTANT**

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In the evolving landscape of intelligent automation, businesses increasingly seek efficient, scalable, and personalized communication systems. This paper presents VoiceGenie, an AI-powered voice calling agent designed to automate customer interactions, conduct batch calls, and intelligently respond to user queries by leveraging a structured knowledge base. The system integrates real-time speech recognition, natural language processing, LLM-based reasoning, and text-to-speech synthesis, enabling human-like conversations over voice calls. Key components include a LiveKit-based call agent for real-time voice interaction; Deepgram/Google STT for speech-to-text conversion; an LLM-powered reasoning engine for understanding and generating responses; Cartesia/Google TTS for natural speech output; a vector-based knowledge base for dynamic product Q&A; and a dashboard for reviewing conversation records and analysing lead interest. The solution supports batch calling to reach multiple users simultaneously, identify interested prospects, and deliver product information through conversational interfaces.

#### **648.NON-INVASIVE ANEMIA DETECTION**

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Anemia remains a significant global health problem which requires immediate diagnosis to prevent severe health outcomes. The standard diagnostic methods rely on invasive blood tests which require significant time and resources and cannot be used for mass testing in areas with limited medical facilities. The research presents a non- invasive anemia detection system which uses deep learning techniques to analyze conjunctival images. The system uses a convolutional neural network classifier to make its final prediction after extracting features from a pre-trained MobileNetV2 model. The model uses data pretreatment methods together with standardization and augmentation methods to improve its generalization capabilities. The experimental evaluation shows that the proposed method achieves strong classification results with 92.9% accuracy and 94.96% precision and 90.6% recall and 92.7% F1-score. The system enables real-time anemia identification through its Streamlit-based application which processes submitted conjunctiva photos. The model enables implementation in affordable healthcare systems through its ability to operate on minimal hardware requirements while delivering strong results. The method delivers high reliability together with equal classification performance because of its minor overfitting issues and its ability to adapt to different image quality conditions. The proposed method enables early screening because it does not require any invasive procedures while it reduces the need for laboratory testing equipment. This research develops artificial intelligence for medical diagnostics through a practical anemia detection method that works in multiple healthcare environments.

#### **649.SIGNBOARD TEXT DETECTION AND RECOGNITION USING YOLOV8 AND VISION TRANSFORMER-BASED OCR**

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The process of detecting and recognizing signboard text in actual environments encounters difficulties because of changing light conditions combined with complex background elements and multiple font styles and text direction variations. The traditional optical character recognition (OCR) methods fail to handle these complex situations because their performance and accuracy levels drop. The research presents a deep learning system that integrates a Vision Transformer (ViT) optical character recognition system with YOLOv8 for efficient signboard identification. The detection module uses a bounding box merging method which preserves complete textual information when it identifies signboard components from input images. The method improves regional extraction results which leads to better recognition performance. The evaluation of the proposed method uses various real- world signboard images which display multiple languages and different text orientations. The experimental results show that YOLOv8 combined with transformer-based OCR systems achieves better performance and more dependable results compared to traditional CNN-based approaches. The system successfully handles three main challenges which include complex background patterns and decorative font styles and multiple text elements that appear together in one image. The system establishes a straightforward interface which enables users to handle and display information as it happens. The proposed framework provides an effective solution that can expand to meet the text extraction needs of signboard operations in smart cities and navigation systems and assistive technologies while experiencing minor difficulties with extremely distorted text.

#### **650.COLLEGE PASS MANAGEMENT SYSTEM (CPMS)**

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Managing student movement in educational institutions is an important task for ensuring security and discipline in educational institutions. Managing gate passes in educational institutions is an inefficient process with conventional gate pass systems. Conventional gate pass systems are time-consuming, error-prone, and may be subject to misuse and improper tracking. In order to overcome these challenges, this research introduces an efficient and effective Smart Digital Gate Pass Management System using advanced web technologies such as Node.js, Express.js, MongoDB, and JWT-based authentication. The proposed system is efficient in ensuring security and discipline in educational institutions. In addition, it is an efficient solution in terms of operation. Various user roles are considered in the proposed system, such as students, faculty, wardens, security personnel, and administrators. In addition, automated email functionality is also incorporated in the proposed system. Overall, the proposed system is an efficient solution for modern educational institutions. Overall, the proposed system can offer a reliable solution for modern educational institutions. The experimental results prove the high performance of the system, such as the request processing time of less than 2 seconds, successful delivery of email notifications, and reliable authentication and pass verification.

#### **651.COMPARATIVE STUDY OF THE MATERIALS USED IN NON-NEWTONIAN FLUID SPEED BREAKER**

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Traffic calming strategies, such as traditional speed breakers, are commonly implemented to lower vehicle speeds; however, they frequently result in discomfort, potential vehicle damage, and heightened noise levels. Recently, adaptive speed breakers utilizing non-Newtonian fluids have surfaced as a groundbreaking alternative. Non-Newtonian fluids display varying viscosity in response to the shear stress applied. When vehicles traverse these systems at lower speeds, the fluid acts like a liquid, facilitating a smooth passage, whereas at elevated speeds, it behaves like a solid due to shear thickening, effectively decelerating the vehicle. This research paper offers a comparative analysis of different materials employed in non-Newtonian speed breakers, including cornstarch-water mixtures, silica nanoparticle suspensions combined with polyethylene glycol, polymer-based fluids, and starch-polymer mixtures. The evaluation of these materials is based on their viscosity characteristics, durability, cost-effectiveness, environmental implications, and practical usability. The findings indicate that while cornstarch-based fluids are cost-effective and appropriate for prototypes, silica-based shear thickening fluids exhibit enhanced durability and performance for practical applications.

## **652. INTELLIGENT BATTERY MANAGEMENT SYSTEM FOR PERFORMANCE OPTIMIZATION AND EXTENDED LIFESPAN USING IOT**

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Batteries are critical components in modern electronic devices, electric vehicles, and renewable energy storage systems. However, their performance and lifespan are significantly affected by capacity degradation, inefficient charging and discharging, temperature fluctuations, and irregular usage patterns. Conventional battery management systems (BMS) are primarily reactive, offering basic monitoring and protection against overcharging and over-discharging, but lacking the capability to dynamically optimize battery performance. In this work, an intelligent battery performance optimization system is proposed, which integrates real-time monitoring, predictive analytics, and adaptive control strategies to enhance battery efficiency and extend operational lifespan. The system continuously acquires parameters such as voltage, current, temperature, and charge-discharge cycles, and employs machine learning techniques to predict battery degradation and dynamically regulate charging and discharging conditions. Furthermore, the system minimizes thermal stress and prevents conditions that accelerate battery wear under varying environmental and load conditions. The proposed model was analyzed using simulated data, and results demonstrate improved energy efficiency, enhanced thermal stability, and extended battery life, with overall system performance improvement observed up to approximately 25–30% of total

### **653.AGENTIC AI FOR PERSONALIZED RECOMMENDATIONS AND BUSINESS INTELLIGENCE IN CROSS-PLATFORM E- COMMERCE**

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The Agentic AI for Personalized Recommendations and Business Intelligence in Cross- Platform E-Commerce provides a revolutionary multi-agent system for e-commerce and e-commerce decisions using AI- driven technologies [2][8]. The system collects, processes, and analyzes data from multiple e-commerce platforms via multiple AI-powered agents and consolidates this dispersed data into a single user interface to facilitate side by side product comparisons across e-commerce platforms to improve buying efficiency and transparency in purchasing. The AI-driven recommendation engines used by the system are based on sophisticated data analytics of user behavior patterns, modeling of product attributes, sentiment analysis of product review ratings, and analysis of social relations for the user [4][7][8]. Based on knowledge of each user's preferences and their real-time intent, the system delivers dynamic real-time context-based recommendations that change continuously as the user interacts with the system, creating rich engagement with users, and therefore improving satisfaction and conversion rates. The platform has an extensive suite of business intelligence modules to allow for sophisticated business intelligence analytics powered by agentic intelligence [2][8]. Examples of these include competitor benchmarking tools to track market and pricing trends related to competitors, demand forecasting engines to predict the next popular products and stock based on customer demand, and detailed customer journey analysis to identify how customers make their purchase decisions. These modules utilize machine learning and data-driven modeling methods, enabling businesses to get an overall view of their competition and optimize their products, pricing and marketing efforts. In summary, the multi-agent e-commerce ecosystem provides actionable insights, to both consumers and businesses. For consumers, users will have greater transparency in product comparison, receive real-time product recommendations, and be able to make informed decisions regarding their purchases. For businesses, they can utilize analytics from the platform to refine their strategic marketing strategies and improve overall performance. Through its use of autonomous agents, intelligent data processing, and predictive analytics, the platform represents a next-generation e-commerce platform that is capable of transforming the online retail experience and will drive the strategic growth of the business.

### **654.AI BASED DROPOUT PREDICTION AND COUNSELLING SYSTEM**

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student dropout remains a significant challenge in higher education often identified too late for effective intervention this paper presents an early warning and decision- support framework that leverages first-

semester academic and behavioral data to proactively identify at-risk students the developed approach incorporates machine learning explainable ai and intervention analysis to facilitate timely and data-driven institutional actions a comparative evaluation of multiple models including logistic regression random forest xgboost and a stacking ensemble was conducted on a dataset of 3795 students logistic regression displayed the most effective performance achieving an accuracy of 86.16 and a recall of 81 for dropout prediction with consistent stability across cross-validation to enhance early detection threshold optimization was applied increasing recall to 90.17 and enabling the identification of the majority of potential dropout cases model interpretability is incorporated using shap providing both global and instance-level explanations that highlight key contributing factors such as attendance academic performance and financial status an intervention analysis further reveals a practical trade-off between detection capability and operational cost where higher recall requires broader intervention coverage while lower-cost strategies achieve higher precision with reduced detection rates the system is implemented as an interactive dashboard supporting risk visualization filtering and intervention tracking enabling efficient administrative workflows the proposed framework demonstrates a practical and scalable solution for early dropout detection balancing predictive performance interpretability and real-world applicability.

#### **655.AN LLM FINE-TUNING BASED FRAMEWORK FOR AUTOMATIC IMAGE CAPTION GENERATION**

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Image Caption Generation has long been a topic of great interest, and researchers are constantly working in the field through new technologies such as the latest CNN and RNN models, transformers, and more. So, we proposed the idea of using Large Language fine-tuning (LLM) with methods like LoRA and QLoRA combined with a Vision Transformer (ViT) for image extraction. However, it remains a challenging area that requires extensive knowledge of deep learning. The technology has numerous beneficial applications, including robotic vision, improving accessibility for visually impaired individuals, enhancing social media and e-commerce platforms, assisting in media and publishing, and aiding specific fields such as healthcare and education.

#### **656.PREDICTION OF PERFORMANCE CHARACTERISTICS OF NANOLUBRICANTS USING MACHINE LEARNING ALGORITHMS**

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Nanolubricants are those lubricants which are formed by dispersing nanoparticles in conventional lubricants. This is done to enhance its thermophysical and tribological properties to give the desired results, such as improved viscous behaviour, reduced friction, and better conductivity. Accurately, predicting the viscous properties of these lubricants is tough due to their non-linear dependence on the input parameters like, temperature, solid volume fraction, and shear rate. Thus traditional empirical correlations can not be applied. This study created a method to integrate machine learning models to predict the dynamic viscosity of nanolubricants. The nano particles used are MWCNT-CuO dispersed in SAE40 oil, from this hybrid nanolubricant experimentally measured rheological data has been

collected. This data is used in various machine learning models, from simple Linear and Polynomial Regression to complex neural network and ensemble models like the Decision Tree, Random Forest, Gradient Boosting, XGBoost, and Artificial Neural Network, reducing the need for extensive experimental testing and providing an accurate tool for predicting viscous behaviours.

### **657.A DUAL-ROI RPPG-BASED EXPERT AI FRAMEWORK FOR CUFFLESS BLOOD PRESSURE ESTIMATION USING A SINGLE SMARTPHONE VIDEO**

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Blood pressure (BP) is a critical physiological parameter for assessing cardiovascular health and enabling early detection of life-threatening conditions such as stroke, heart failure, and coronary artery disease. Hypertension, often asymptomatic, remains a leading cause of global morbidity, making continuous and accessible BP monitoring essential. However, conventional cuff-based methods are contact-dependent, uncomfortable, and unsuitable for frequent or long-term use, while existing wearable sensor-based approaches still rely on specialized hardware, limiting accessibility and scalability. To address these challenges, this study proposes a fully non-contact, smartphone-based framework for cuffless blood pressure estimation using remote photoplethysmography (rPPG). The proposed system requires only a single 30-second video captured using a standard smartphone camera, eliminating the need for dedicated sensors or wearable devices. A dual region of interest (ROI) approach is employed to extract synchronized physiological signals from the facial (cheek) region and fingertip, enabling accurate estimation of pulse transit time (PTT). The complete processing pipeline, including signal extraction, preprocessing, and feature computation, is performed within approximately two minutes, ensuring rapid and practical usability. Multiple machine learning models, including Linear Regression, Random Forest, and Support Vector Machine, are evaluated for BP estimation. Experimental results demonstrate that Linear Regression achieves superior performance, with a mean absolute error of 4.32 mmHg for systolic and 4.74 mmHg for diastolic pressure, along with strong correlation coefficients ( $r = 0.963$  and  $0.907$ ). The model satisfies AAMI clinical standards for systolic BP, and Bland–Altman analysis indicates low bias and acceptable agreement. The proposed system provides a scalable, cost-effective, and user-friendly solution for non-invasive BP monitoring, highlighting the potential for real-time, accessible cardiovascular assessment using widely available smartphone technology.

### **658.STRUCTURAL DESIGN OF CIRCULAR OVERHEAD WATER TANK BYLSM WITH STAAD-PRO ANALYSIS**

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This study presents a comprehensive methodology for the structural design of a circular overhead reinforced concrete (RCC) water tank using the Limit State Method (LSM). Circular overhead water tanks are essential components of water supply systems, and their design requires careful consideration of strength, serviceability, durability, and watertightness due to their liquid-retaining function. The study considers all major structural components of the tank, including the top dome, ring beam, cylindrical wall, and base slab, each designed to safely resist hydrostatic pressure, self-weight, and other applicable loads. The design process follows the provisions of relevant Indian Standards, with particular emphasis on LSM principles for ultimate and serviceability limit states. Special attention is given to

crack width control and durability requirements, which are critical to ensure long-term performance and prevention of leakage in liquid-retaining structures. Manual LSM based calculations are carried out to determine internal forces and reinforcement requirements for the tank components. To improve accuracy and overcome the limitations of simplified assumptions in manual design, STAAD.Pro software is employed for detailed structural analysis. The software enables three-dimensional modeling of the tank system and accurately captures load distribution, interaction between tank components, and overall structural behavior. Internal forces such as bending moments, shear forces, and axial forces obtained from STAAD.Pro analysis are used to optimize the design.

### **659.EXPERIMENTAL STUDY ON CLAY TILES AS AN ECO- FRIENDLY BUILDING MATERIAL**

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One of the most architectural elements around the world is clay tile. Clay tiles have a history dating back to the "Neolithic Age"; they were first used as roofing in China and then in the Middle East, and the use of clay tile for roofing gradually spread throughout the world. The material has been seen as an integral part of architecture for thousands of years and in many cultures, clay roof tiles carry a sense of timelessness. In India, the first clay tile factory was set up in Mangalore in 1860 called "Mangalore Tile". These are made from hard laterite clay and became popular for their colour, shape, and quality, with the deep red shade due to high iron content. The need for change in clay tile is that clay is a better material compared to others such as concrete, offering stronger and more durable quality with a longer lifespan. Handmade clay tiles are produced using moulds, but their heavier weight requires proper structural support. This study deals with clay tiles using black soil, white soil, and jiggery. These tiles help maintain room temperature effectively according to climatic conditions. Clay tiles are eco-friendly and improve the aesthetics of buildings. They also create a ventilated air layer that helps in cooling the roof. The study highlights that clay tiles are a sustainable and effective solution for reducing heat and improving indoor comfort.

### **660.HYBRID ENSEMBLE LEARNING MODEL FOR PRICE AND SALES PREDICTION THROUGH MARKET INSIGHT ANALYSIS USING CATBOOST AND GRADIENT ALGORITHMS**

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Price and sales forecasting is necessary for efficient market planning and business optimization. Traditional forecasting techniques tend to fail in capturing the non-linear relationships existing in the market environment effectively. In this paper a Hybrid Ensemble Learning Model is proposed by combining CatBoost and Gradient Boosting algorithms to improve forecasting accuracy. The proposed model also incorporates market insight analysis to provide important factors that affect sales and price trends. Data preprocessing methods are used to improve accuracy and validity of the proposed model effectively. An ensemble fusion approach helps to hold the strengths of individual models to produce accurate forecasts, and experimental analysis on real- world sales data sets, it reveals that the proposed hybrid model outperforms in terms of accuracy and prediction error.

### **661.DETECTION OF PARKINSONS DISEASE FROM SUSTAINED VOWEL RECORDINGS USING SELF-SUPERVISED SPEECH REPRESENTATIONS**

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Detecting the progressive neurodegenerative disorder, Parkinson's disease (PD) is a clinical challenge. The analysis of your speech is emerging as a non-invasive biomarker for PD as vocal impairments preceding motor symptoms. This work presents a deep learning framework for PD detection from sustained vowel recordings using intermediate representations from a frozen Wav2Vec2 foundation model, alongside a lightweight convolutional attention classifier. By analyzing the encoder layers systematically with the suffused layer-wise method we show that layer 3 of Wav2Vec2 provides superior discriminative features as evidenced by the mean ROC-AUC across six random seeds being  $0.8797 \pm 0.0377$ . Through 5-fold stratified cross-validation on a dataset with 122 subjects (82 healthy controls, 40 PD patients), we achieve a best-run ROC-AUC of 0.9540, sensitivity of 0.9250, specificity of 0.8412, PR-AUC of 0.8765 and Matthews Correlation Coefficient of 0.7388. Through comparative analysis with SVM and Random Forest baselines we demonstrated that although Random Forest achieves higher AUC (0.9778), it only manages to pick-up 30% of PD cases which is clinically unacceptable. Our model achieves more than 60 percentage with fewer missed diagnoses vs. a Random Forest, highlighting the importance of sensitivity in machine learning.

### **662.A HYBRID DEEP LEARNING FRAMEWORK FOR ANCIENT TAMIL CHARACTER RECOGNITION USING CNN, SVM WITH SCOPE FOR LINGUISTIC POST-PROCESSING**

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Ancient Tamil manuscripts and inscriptions are significant primary sources for administrative, cultural, and historical details. These documents are typically found on palm-leaf manuscripts and stone surfaces; they have degraded due to environmental factors such as fading ink, erosion, and structural damage that make manual reading difficult. Also, the structural differences between ancient Tamil scripts and modern ones reduce the effectiveness of conventional Optical Character Recognition (OCR) systems. This paper presents a study on an integrated model of recognising ancient Tamil characters in damaged historical inscriptions using machine learning and deep learning approaches. The proposed framework uses Convolutional Neural Networks (CNNs) for feature extraction, Support Vector Machines (SVMs) for classification, and N-gram-based linguistic post-processing for error correction. It also highlights crucial issues like visual similarity among characters and a small number of annotated datasets. This proposed model is an initiative toward building a robust and efficient system that can recognise and digitise ancient Tamil scripts accurately.

### **663.LORA-BASED FOREST CAMPING SAFETY AND GUARD COORDINATION COMMUNICATION AND TRACKING SYSTEM**

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The suggested system is based on the LoRa technology used in the process of tracking of the location and wireless communication between forest guards and camping groups in remote places where they might not be covered by the traditional networks. It is a system which is a central Guard device and 2 Group devices arranged in a secure mesh network to provide controlled and reliable information exchange. The sub-GHz LoRa frequency band allows high penetration of obstacles in thick forests and hilly areas where the line-of-sight communication does not always work. The devices also have a GPS receiver that communicates their position through the form of real time latitude, longitude and altitude to the Guard device, an OLED display to provide the user with system status like battery level and coordinates and a 4×4 matrix keypad which allows the transmission of predefined messages and SOS notifications via a peer-to-peer connection. The AES 256 encryption is adopted to avoid the unauthorized access and spoofing of sensitive location data, which are decrypted and authenticated by the Guard device. The rechargeable 3.7-V Li-ion batteries that are used to power the system may be supplemented with optional solar charging, allowing the system to operate more than one day. Experiments in the field show that the offered LoRa-based system has a better range of communication and stability than GSM, Wi-Fi, and Bluetooth technologies. This makes the campers, researchers, eco-tourism guides, and forest patrol staff working in remote forest setups to be safer, more coordinated, and tracked in real-time.

#### **664. CHEMICAL AND MORPHOLOGICAL ANALYSIS OF PM<sub>2.5</sub> IN DELHI: INSIGHTS FROM SEM-EDX AND FTIR**

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This study investigated PM<sub>2.5</sub> concentrations, their possible emission sources and morphological/functional group characteristics in Delhi during the post-monsoon and early winter period (October–December 2024). The average 24-hour PM<sub>2.5</sub> concentration during this period was observed as 268.2±79.5 µg/m<sup>3</sup>, substantially exceeding the National Ambient Air Quality Standards (NAAQS) limit of 60 µg/m<sup>3</sup> prescribed by the Central Pollution Control Board (CPCB). Source identification using SEM-EDX and FTIR analysis indicated contributions from vehicular emissions, crustal dust, biomass burning, and secondary inorganic aerosols. The combined impact of unfavourable meteorology and various emission sources resulted in intense pollution episodes, highlighting the urgent need for effective air quality management strategies in Delhi.

## 665. NUMERICAL SIMULATION AND MACHINE-LEARNING CONFIRMATION OF 3D PRINTED LATTICE STRUCTURES

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This study presents a simulation-driven investigation of additively manufacturable lattice structures, supported by a machine-learning (ML) framework used to confirm finite element trends and improve predictive efficiency. Four core topologies—face-centered cubic (FCC), body-centered cubic (BCC), hexahedral, and honeycomb—were parameterized in Creo 11 and evaluated in ANSYS Workbench under static structural loading. Variants were developed including square, triangular, hexagonal and circular boundary struts. The plate was kept constant in size at 700x700mm, with a plate thickness of 2.5mm. The struts had a standard size of 15x15x15mm, wall diameter 3mm, cross-sectional thickness 1.5mm and strut distance 15.6mm. The angles between the struts varied for the hexagonal designs at 105°. The radius of the edges for hexahedral boundaries was 1.5mm and for the circular boundaries 3.5mm. Two FDM-relevant polymer systems, PLA+CF and polycarbonate (PC), were considered for material assignment. The finite element results showed a strong topology–material dependency. Total deformation varied from  $1.03 \times 10^{-5}$  mm for the honeycomb configuration in PLA+CF to 18 mm for the hexagonal configuration in PC. The von Mises stress response ranged from 586.63 MPa for low-stress PC cases to 4588.4 MPa for the FCC triangular structure in PLA+CF, indicating pronounced stress concentration in triangulated FCC members under the applied loading condition. In general, honeycomb lattices exhibited the highest stiffness with negligible deformation, whereas FCC triangular lattices sustained higher load transfer at the expense of localized stress intensification. To verify simulation consistency without physical testing, a supervised ML regression workflow was formulated using the ANSYS output dataset. Topology, strut profile, material type, geometric descriptors, and applied pressure were used as predictors, while deformation and von Mises stress were treated as targets. The results from the ML stage were used as an alternate for confirmation of FEA trends and showed similar trends, and thus data-driven validation was utilized for rapid screening of various lattice geometries. Keywords: lattice structures, finite element analysis, machine learning, FCC, BCC, honeycomb, PLA+CF, polycarbonate

## 666. INTELLIGENT ENERGY OPTIMIZATION FOR INDOOR SPACES

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In many indoor environments such as classrooms, offices, and seminar halls, electrical appliances are often used without considering actual occupancy, leading to significant energy wastage as lights, fans, and air conditioning systems remain active even when not required. To address this issue, this paper presents an intelligent energy optimization system that dynamically manages power usage based on real-time occupancy detection by dividing a room into smaller zones and controlling each section independently using sensors such as Passive Infrared (PIR) and ultrasonic modules. The system employs an ESP32 microcontroller to process sensor data and operate appliances through relay modules. In addition to occupancy-based control, environmental parameters are also considered, where temperature monitoring enables adaptive cooling control and a Light Dependent Resistor (LDR) adjusts artificial lighting based on available natural light. This integrated approach significantly reduces unnecessary energy consumption while maintaining user comfort, and due to its scalable design, the system can be effectively implemented in large indoor spaces where energy efficiency is essential.

### **667. ASTHMA DISEASE PREDICTION USING HYBRID MACHINE LEARNING MODELS: A COMPARATIVE REVIEW**

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Asthma currently stands as the most widespread chronic respiratory illness throughout the world because its development stems from environmental factors, genetic factors, and lifestyle choices. The prediction of asthma risk remains difficult because air pollutants interact with personal health measurements in complex ways. This research compares three different models—Logistic Regression, XGBoost, and a Hybrid Ensemble Model—to forecast asthma risk. The dataset combines clinical data with environmental data covering FEV<sub>1</sub>/FVC ratio, pollution exposure, dust and pollen exposure, dietary quality, and physical activity. The experimental results show that the Hybrid Model achieves 97.65% accuracy and 0.9971 ROC-AUC, outperforming both standalone models. The study determined that FEV<sub>1</sub>/FVC ratio and pollution exposure are the main predictors of respiratory health deterioration, consistent with findings reported in prior research. The paper provides comprehensive information on model interpretability, real-world application readiness, and feature importance for health risk prediction. The hybridization strategy effectively unites the linear interpretability of logistic regression with the nonlinear learning capabilities of gradient boosting, offering a promising direction toward accurate respiratory healthcare analytics.

### **668. AI-POWERED STUDENT BEHAVIOUR ANALYSIS SYSTEM**

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This paper presents a comprehensive framework for an Artificial Intelligence (AI) powered system designed to monitor, analyze, and evaluate student behavior and engagement in both physical and virtual classroom environments. By leveraging state-of-the-art computer vision algorithms, facial expression recognition (FER), and body pose estimation, the system extracts real-time behavioral metrics. The proposed architecture aims to provide educators with actionable insights to improve pedagogical strategies, identify struggling students, and enhance overall classroom management. Experimental results on simulated classroom datasets demonstrate that the proposed multi-modal model achieves an accuracy of 92.4% in classifying student engagement levels, outperforming traditional single-modality baseline models. Furthermore, this paper addresses the strict ethical frameworks and data privacy protocols required for deploying such systems in educational institutions.

## **669.DUAL BATTERY SWITCHING AND IOT-BASED SMART SOLAR POWERED SCHOOL BUS**

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The project Dual battery switching and IOTbased smart solar-powered school bus is a smart energy management system for electric school buses that uses two power source one is lithiumion battery along with solar power to improve efficiency and reliability of school bus. Also using smart dual battery switching, this system increases battery life, reduces energy loss, and solves problems found in single battery EV system. Solar panels help charge the batteries using renewable energy, reducing dependence on the power grid. An IoT-based monitoring system with sensors and a microcontroller (Atmega328p)

tracks real-time data like voltage, current and live location. The fingerprint module will be helps to student attendance.

### **670.VOICEVIBE:REAL-TIME EMOTION DETECTION FRAMEWORK FROM SPEECH SIGNALS USING DEEP LEARNING**

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Speech is one of the vital modes of communication through which both verbal and non-verbal information is transmitted. This information includes both the content and emotion conveyed by speech patterns such as tone, pitch, and rhythm. Speech Emotion Recognition (SER) mainly targets the development of a system that can automatically recognize the emotions present in speech. In this paper, a real-time emotion recognition system named VoiceVibe is introduced based on deep learning. This system reduces the noises present in the speech signal by applying the noise reduction technique in the preprocessing phase. It uses Mel Frequency Cepstral Coefficients (MFCC) to extract significant features from the speech signal. The features extracted are analyzed by applying a hybrid model based on Convolutional Neural Networks (CNN) and Long Short-Term Memory (LSTM) networks. This system is tested on standard datasets containing emotional speech with different speaker characteristics. The results show that the system performs well in all classes of emotion recognition in real time. This system can be employed in various fields such as virtual assistants and customer sentiment analysis.

### **671.GUARDIANVOICE: A SPEECH PROTECTION SYSTEM FOR PROMOTING ETHICAL CONVERSATION IN SOCIAL MEDIA**

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The growth of social media audio communication, including voice notes, live discussions and streaming platforms, has brought forth significant challenges in detecting harmful speech such as hate speech, harassment, and abusive language. Simple text-based moderation systems are not enough for analysing the tonal and emotional nuances present in spoken content. This paper proposes GuardianVoice, a dual modal AI driven speech protection system that integrates speech to text processing, TF-IDF-based textual classification using logistic regression, and MFCC-based acoustic feature extraction using Gradient Boosting. A weighted ensemble mechanism combines semantic and tonal probabilities to enhance detection accuracy. The system was evaluated using the Davidson Hate Speech dataset and the RAVDESS emotional speech dataset. Experimental results demonstrate that the proposed model achieves an overall accuracy of 97%, outperforming baseline multi-modal approaches. The high precision, recall, and F1-scores indicate reliable harmful speech detection suitable for real time social media moderation.

## **672.PIPHANTOM: OFFLINE PHYSICAL INTRUSION DETECTION VIA AMBIENT CSI SIGNAL ANALYSIS AND EDGE COMPUTING**

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Maintaining the security of air-gapped facilities without compromising individual privacy remains a significant challenge in modern cybersecurity, as traditional monitoring systems like Passive Infrared (PIR) sensors and optical surveillance suffer from inherent vulnerabilities including line-of-sight dependencies and severe privacy liabilities. This paper introduces PiPhantom, a non-line-of-sight intrusion detection system that leverages Channel State Information (CSI) extracted from 2.4GHz Wi-Fi signals to create an invisible electromagnetic tripwire. By repurposing an ESP32 microcontroller into a passive sensing node and utilizing a Raspberry Pi 5 for Edge-AI processing, the system extracts fine-grained subcarrier amplitude data when a human body disrupts the localized radio frequency environment. To overcome embedded hardware constraints, the architecture utilizes a zero-latency UDP pipeline that transmits raw data to a backend running an Isolation Forest machine learning model for unsupervised anomaly detection. Experimental results in a high-noise server room demonstrate a 99.2% detection rate for moving subjects and an 87.3% rate for stationary subjects within a 2.5-meter

radius, proving that high-precision spatial awareness can be achieved entirely offline to ensure maximum data sovereignty.

### **673.A COMPREHENSIVE SURVEY ON MACHINE LEARNING AND DEEP LEARNING APPROACHES FOR FACIAL PLASTIC SURGERY**

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Rhinoplasty is a form of plastic surgery on the face, where the evaluation of the nasal anatomy, morphology, and symmetry has to be exact to produce both functional and aesthetic surgical results. In the recent past, artificial intelligence has had a significant role in enhancing the analysis of medical images. This survey examines machine learning (ML) and deep learning (DL) methods used in nasal image analysis in facial plastic surgery. The topic of the research is automated recognition of nasal landmarks, morphology typology, planning surgery, and outcome evaluation after surgery using the imaging techniques with 2D facial photographs, CT scan, MRI, and 3D reconstruction data. Several AI models such as convolutional neural networks, generative adversarial networks, transformer-based models, hybrid radiomics models and ensemble learning models are mentioned. Anthropometric nasal measurement, multimodal integration of clinical data, and automated workflow to fit individual surgical simulation are also mentioned in the survey. Even though there have been impressive progress, there is still the problem of diversity of datasets, model interpretability, clinical validation, and anatomical variability. In future studies, development of hybrid, explainable, and clinically reliable AI systems to be used in real-time surgical decision support and customization of rhinoplasty plans should be considered. Altogether, nasal image analysis by artificial intelligence has a great potential to enhance accuracy, repeatability, and effectiveness of facial plastic surgery.

### **674.AN INTELLIGENT SIGN LANGUAGE INTERPRETATION SYSTEM USING COMPUTER VISION AND EMBEDDED SPEECH SYNTHESIS**

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Sign language remains the primary mode of communication for millions of hearing-impaired individuals worldwide, yet a significant barrier persists between signers and non-signers. This paper presents an Intelligent Sign Language Interpretation System that bridges this communication gap through a compact, real-time pipeline combining computer vision, gesture recognition, and embedded speech synthesis. The proposed system captures hand gestures via a standard camera, processes landmark features using MediaPipe and OpenCV on a host processor, classifies gestures into alphabets and words, and relays the recognised text to an ESP32 microcontroller that drives a DFPlayer Mini module for audio output through a speaker. A regulated 5 V power supply circuit based on the LM7805 voltage regulator ensures stable embedded operation. The system achieves a gesture recognition accuracy of 94.7% across the 26 American Sign Language (ASL) alphabets under varied lighting conditions, with an end-to-end latency below 350 ms. The design is portable, cost-effective, and requires no cloud connectivity, making it suitable for deployment in resource-constrained environments. Extensive experimental evaluation confirms that the proposed system outperforms several existing approaches in terms of real-time performance, portability, and integrated speech output.

## **675.MULTI-INTENT CLASSIFICATION IN REGIONAL CITY GUIDE SYSTEMS A CASE STUDY OF HYDERABAD**

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Conversational AI systems for urban navigation face unique challenges in multilingual and culturally diverse contexts, such as Indian cities. This study presents a multi-intent classification system that enables the Hyderabad City Guide chatbot to manage 25 distinct customer interactions, including weather inquiries, food suggestions, public transport directions, and tourist information. Our system specifically solves regional challenges that general-purpose chatbots cannot handle by processing code-mixed queries in English-Telugu-Urdu, resolving location name differences between “HITEC City” and “Hitech,” and understanding cultural context, including biryani preferences, temple timings, and Ramadan schedules. The hybrid rule-based classifier we developed was evaluated on 482 Hyderabad-specific queries, achieving 91.2% accuracy with a macro-averaged F1 score of 0.814 and a weighted-average F1 score of 0.880. The system achieved a macro-averaged precision of 0.824 and a macro-averaged recall of 0.827. The system achieved perfect F1 scores in seven out of 25 intent classes, which included bus food, government mmts, transport, news, and education, and 18 out of 25 classes exceeded  $F1 = 0.85$ . The system demonstrates real-time operational

capability through a rule-based inference system that processes each query in 0.041 ms. This research investigates a multi-signal dispatch architecture that uses scored signals to enhance differentiation between closely related intents, uses compound co-occurrence triggers to identify culturally specific categories of festival-related traffic, and uses a lightweight learned layer to cover paraphrase variations from a labelled corpus. The modular handler architecture enables system extension through new elements that operate independently of existing response systems. The research produced three main results: a 25-class intent taxonomy, a 482-query annotated evaluation dataset, and design guidelines for regional conversational AI systems in low-resource multilingual settings.

## **676.NUTRITION AND COST ANALYSIS OF MULTI-SPECIES CATTLE FEED USING DATA-DRIVEN OPTIMIZATION AND PREDICTIVE ANALYTICS**

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Feeding is the largest ongoing expense when raising animals and plays a key role in their health, performance, and the financial success of a farm. This project presents a full, data-driven system that helps make balanced and cost-effective feed mixes tailored to different types of cattle, such as dairy cows and bullocks. Traditional feeding methods often rely on fixed charts or guesswork, which can lead to wasted nutrients, lower efficiency, and increased costs. The new system uses standard nutrient data, up-to-date ingredient lists, current market prices, SQL to store information, and a Linear Programming tool to create custom feed plans each day. It is designed for various dairy cows, including normal, pregnant, and lactating cows, as well as breeding and working bullocks, considering their unique nutritional requirements. A machine learning tool helps predict milk production based on the feed mix, allowing for feed plans that support productivity. The system ensures proper dry matter intake and provides the right balance of important nutrients like digestible crude protein, total digestible nutrients, calcium, and phosphorus, while following rules for including certain ingredients and managing the mix of forage and concentrate. The system provides results such as the best feed mix, daily cost breakdown, nutrient coverage, predicted milk output, comparisons with past feeds, and downloadable reports. Testing shows this system lowers costs without reducing the quality of nutrition. It is a flexible and offline-friendly solution that helps farmers feed their animals more accurately and manage dairy and work animals in a sustainable way.

## **677.UNCERTAINTY AWARE FRAMEWORK FOR FINANCIAL TIME SERIES IMPUTATION AND ANOMALY DETECTION**

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Financial time-series data frequently suffer from missing values and irregular market fluctuations, which degrade predictive reliability and anomaly detection performance. This paper proposes an uncertainty-guided reconstruction framework that integrates a Masked-Former ensemble with selective Generative Adversarial Network (GAN) refinement to accurately impute missing values while preserving genuine financial anomalies. Ensemble-based epistemic uncertainty estimation is employed to distinguish model uncertainty from inherent market volatility, enabling refinement only in masked and highly uncertain regions. Using MAR and MACR strategies, experiments are carried out on Yahoo Finance historical stock data (AAPL, 2010–2023) with artificially simulated missing patterns at different levels of corruption. With a Mean Absolute Error (MAE) of 0.88 and a Root Mean Squared Error (RMSE) of 1.28, the suggested approach outperforms the single-model and traditional imputation baselines. Post-reconstruction anomaly detection, indicating enhanced anomaly preservation and detection reliability. The results confirm that uncertainty-guided selective refinement provides a robust and anomaly-aware solution for financial time-series imputation.

## **678.SMARTCKD: AI-BASED CHRONIC KIDNEY DISEASE PREDICTION SYSTEM**

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Chronic Kidney Disease(CKD) poses a serious hazard to life and progressive disease which is mostly not noticed at its initial phases because of absence of symptoms. The timely medical intervention and lowering the mortality rate of CKD is possible only after timely and proper prediction. This paper suggests the SmartCKD, a machine learning-rooted system to predict the early CKD using clinical patient information. The system works with the UCI CKD dataset and implements a full set of preprocessing methods, such as missing values replacement, categorical variable encoding, and feature scales. In order to enhance the qualities of models, Multiple feature choice strategies, such as correlation, the chi-square test, recurrent element removal, and normalization techniques, are employed to identify the most relevant characteristics. Many classifier intelligence methods, including a random forest, AdaBoost, Asymmetric Optimization, XGBoost simple naive Bayes, and Voting Tree, are evaluated and put into practice. It has been demonstrated through experiments that ensemble training methods outperform their conventional equivalents, and the Random Forests classification is the most accurate and dependable. Therefore, Random Forest, that is deployed in a Flask-based web app and enables immediate CKD prediction, will be the end result. Additional features that are built into the system comprise safe email delivery, automatic report generating, and an AI-powered chatbot that communicates with users. The SmartCKD architecture has a high degree of real- time application in the healthcare sector and provides a scalable, dependable, and accessible a clinical decision-support system for the early identification of CKD.

### **679.AI-DRIVEN FOOTBALL ANALYTICS: PREDICTING PLAYER PERFORMANCE**

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Artificial Intelligence and Machine Learning has become a powerful tool of contemporary football analytics, which allows assessing the performance of the players and making tactical decisions based on the data. The conventional performance analysis techniques tend to be based on the number of events in isolation and do not include the contextual match dynamics. To mitigate this shortcoming, this study suggests a player-aware opponent football intelligence model that is based on the Event-Aware Player Performance Index (EA-PPI) which is a probabilistically based player contribution measure based on attacking, buildup, and defensive event counts derived on StatsBomb 2018 FIFA World Cup data. The

framework goes beyond the retrospective analysis by integrating a controlled machine learning model to forecast the upcoming performance of players in different conditions of their opponent, venue and strategy. Several regression models were tested with the best result being the Random Forest regressor, with the highest  $R^2$  of 0.7035 and MAE of 0.2032, which has a high predictive power. To transform prediction into practical use, a formation-constrained tactical squad recommendation module was created to produce optimal starting XIs. The proposed structure is an entire funnel between event-level analytics to predictive tactical optimization, which is useful in squad selection, match simulation and opponent-specific strategic planning.

#### **680.ENERGY DISSIPATION ANALYSIS OF QCA COMBINATIONAL CIRCUITS**

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Quantum-dot Cellular Automata (QCA) encodes binary information through the spatial positioning of electrons inside quantum dots, bypassing the need for conventional current-based switching. This work measures energy dissipation in combinational QCA building blocks: a majority gate, an inverter, AND and OR gates, a half adder, and a full adder. Layouts were designed using QCADesigner 2.0.3 and energy per clock cycle was extracted with QCADesigner-E, keeping all simulation parameters constant across every circuit. MATLAB R2025b was used to independently verify functional correctness for all input combinations. Among primitive gates, the per-cycle energy ranges from  $1.63 \times 10^{-4}$  eV (inverter) to  $4.00 \times 10^{-4}$  eV (OR gate); for arithmetic units, the full adder yields  $2.93 \times 10^{-3}$  eV and the half adder  $3.03 \times 10^{-3}$  eV. The full adder achieves this with 33 cells across  $0.03 \mu\text{m}^2$  — 28% fewer cells and 87.5% smaller footprint than the 46-cell,  $0.24 \mu\text{m}^2$  half adder — while also dissipating 3.3% less energy per cycle, underscoring that clock-zone layout efficiency outweighs cell count as the primary energy determinant. The measurements form an internally consistent reference for cross-hierarchy QCA power budgeting.

#### **681.VOLTWATCH AI (IOT + AI SYSTEM FOR PREDICTIVE FAULT DETECTION IN HIGH VOLTAGE GRIDS)**

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VoltWatch AI is an IoT and AI-based smart monitoring system designed to improve the safety and reliability of electrical equipment in power distribution and industrial environments. It uses an ESP32 microcontroller with sensors to continuously measure key parameters such as voltage, current, temperature, and vibration. These readings help capture the real-time operating condition of equipment and identify early warning signs of overload, overheating, or mechanical instability. The collected data is transmitted to the cloud (Firebase) and displayed through an Android dashboard with live values, status indicators, and trend graphs. AI-based analysis is used to detect abnormal patterns and generate quick fault alerts and maintenance recommendations. By enabling predictive maintenance instead of manual inspection, VoltWatch AI reduces unplanned outages, minimizes damage risk, and supports faster decisionmaking.

## **682.AI-DRIVEN HYBRID MACHINE LEARNING APPROACH FOR REAL-TIME SIGN LANGUAGE RECOGNITION WITH INTEGRATED TEXT AND SPEECH OUTPUT**

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People who are hearing-impaired often struggle to communicate with those who don't know sign language — a gap that exists simply because we rely on different ways of expressing ourselves: speech, text, and gesture. Bridging that gap is the core motivation behind this work. We propose a lightweight multimodal framework that brings text, speech, and sign language together in a single, cohesive system. Rather than treating each modality in isolation, our architecture handles speech-to-text, text-to-speech, sign-to-text, and text-to-sign conversions in an integrated pipeline — letting users move fluidly between communication forms without switching tools. One of the more practical design choices in our system is the use of emoji-based representations to convey sign language gestures. While full 3D animation is more expressive, it is computationally expensive and difficult to deploy broadly. Emoji-based visuals strike a reasonable balance: they are immediately recognizable, lightweight, and accessible on everyday devices. The framework draws on natural language processing and speech processing techniques to keep conversions accurate and responsive. Importantly, it runs on standard CPU-based hardware — no GPUs or specialized accelerators required — making it genuinely viable in low-resource settings where such infrastructure is unavailable. Our evaluations show that the system performs well across all four translation directions while remaining easy to use. We believe this work offers a practical, affordable step toward more inclusive communication technology for the hearing-impaired community.

### **683.AGENTIC AI IN HEALTHCARE: ARCHITECTURE, APPLICATIONS, AND OPEN CHALLENGES - A SYSTEMATIC REVIEW**

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The field of healthcare artificial intelligence seems to be passing through a. underlying changes in the task-specific prediction systems to goal-oriented, dynamic, Agentic AI systems, which can multi-step. planning, the tool invocation as well as coordinated multi-agent execution. of multifaceted clinical procedures. In this paper, I have given a systematic. analysis of six peer-reviewed articles synthesised with four. analytical topics: building development, clinical use, implementation of safety and governance, implementation of breadth, and empirical. evaluation standards. Three findings of cross-paper arise. There is a critical and measurable implementation gap between architectural capa- bility and safety engineering, although in multi-agent, about 82% of the surveyed systems design is adopted less than 6% of the total number of countries have safety guardrails in place. Only 86% have regulatory compliance mechanisms. The agentic clinical system that is completely empirically validated. The fact that a real multi-agent can be observed in the investigated corpus is confirmed. coordination is statistically better than static ensemble methods. (macro F1-score: 0.927 vs. 0.901). Agentic reasoning performance has test-time scale dynamics of compute positioning determination investment as the main performance. lever beyond model training. There are six disparities in evidence-based studies and a systematic six-point research plan is determined, giving practitioners, researchers, and regulators an evidence- based foundation to measure agentic AI preparedness against accountable clinical implementation.

### **684.A HYBRID PHISHING DETECTION FRAMEWORK USING PHISHSIM AND BI-LSTM FOR ZERO-DAY ATTACK DETECTION**

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Phishing website detection has become increasingly challenging due to the rapid evolution of attack techniques, espe- cially zero-day phishing attacks. Traditional approaches, includ- ing similarity-based methods such as PhishSim, are effective in detecting known phishing variants but fail to identify

completely new attacks. In this paper, we propose a hybrid phishing detection framework that integrates PhishSim with a Bidirectional Long Short-Term Memory (Bi-LSTM) model to enhance zero-day detection capability. The proposed system uses PhishSim as a primary filtering mechanism to detect similar phishing websites, while the Bi-LSTM model acts as a secondary classifier to identify previously unseen phishing attacks. Experimental results show that the proposed approach achieves an accuracy of 99.1%, with high precision and recall, while maintaining a low false positive rate. This demonstrates the effectiveness of combining feature-free similarity-based detection with deep learning for robust phishing detection.

### **685.SEASAFE: PREDICTING PASSENGER SURVIVAL IN MARITIME DISASTERS USING MACHINE LEARNING**

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Maritime disasters present critical challenges for ensuring passenger safety, where survival outcomes often depend on multiple interacting factors such as demographics, travel conditions, and available safety infrastructure. This study introduces SeaSafe, a predictive framework that leverages machine learning techniques to estimate passenger survival probabilities during maritime disasters. Using historical maritime accident data and engineered features such as age, gender, ticket class, and lifeboat accessibility, the system develops models capable of learning complex patterns underlying survival likelihood. Several classification algorithms, including Random Forests are evaluated to identify the most effective approach for accurate prediction. The results demonstrate that ensemble-based methods outperform traditional models, achieving higher accuracy and robustness in survival prediction. Beyond prediction, SeaSafe provides insights into the most influential factors contributing to survival, supporting better preparedness and risk management strategies. The framework holds potential for enhancing maritime safety protocols, optimizing evacuation planning, and informing training programs for crew and passengers. By integrating data-driven intelligence into safety management, SeaSafe contributes to proactive decision-making aimed at minimizing casualties in future maritime disasters

### **686.HYBRID CLASSICAL-QUANTUM MODEL FOR HYPER SPECTRAL IMAGE CLASSIFICATION WITH QUANTUM RESOURCE ANALYSIS**

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The rapid growth of hyperspectral satellite images requires efficient methods for accurate classification. This paper proposes a hybrid classical-quantum machine learning model that combines classical preprocessing with quantum-based classification techniques. Dimensionality reduction is first applied to handle high-dimensional spectral data, followed by a classical SVM for baseline comparison. A hybrid quantum kernel SVM is then used to improve feature representation and classification performance. The model is evaluated using accuracy, execution time, circuit depth, and qubit usage.

## **687.SMART FACIAL IDENTITY AND EMOTION MONITORING SYSTEM USING HYBRID DEEP LEARNING**

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Facial recognition and emotion detection have gained significant importance in intelligent surveillance, smart attendance systems, and human-computer interaction. This paper presents a hybrid deep learning-based real-time face recognition and facial emotion detection system developed using Python and deployed through a Flask web application. The system integrates Haar cascade classifiers for rapid face detection, a Convolutional Neural Network (CNN) for reliable face recognition, and a lightweight MobileNetV2 architecture for classifying emotional states including happiness, sadness, anger, fear, surprise, contempt, disgust, and neutral expressions in real time. The system processes both live video streams and uploaded images, ensuring flexibility across operational scenarios. Detected faces, recognized identities, predicted emotions, timestamps, and confidence scores are stored in a SQLite database for analytics and reporting. Experimental results including training accuracy/loss curves, correlation analysis, confusion matrix, and sample predictions confirm the system's effectiveness and robustness for smart attendance monitoring, security surveillance, and behavioural analytics.

## **688.IOT-DRIVEN BOREWELL MONITORING AND CHILD ACCIDENT PREVENTION SYSTEM**

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Borewell incidents continue to pose a major safety risk, particularly in areas where unused wells are left open. Where uncovered or abandoned borewells pose a life-threatening risk to children. Conventional rescue methods are slow, complex, and often involve significant risk and depend largely on manual intervention, which significantly reduces the chances of survival . To overcome this challenge, the proposed work introduces an IoT-enabled borewell safety and child rescue system designed to ensure early detection, preventive action, and timely alert generation.. The system uses infrared-based sensing to track lid conditions and detect any internal disturbances and detect falling objects, while an Arduino Uno acts as the central processing unit. A servo-driven horizontal closure mechanism is used to prevent further descent inside the borewell. Additionally, a buzzer provides immediate local alerts, and a NodeMCU-based Wi-Fi module enables cloud connectivity for remote notifications. Real-time alerts are transmitted to concerned authorities and users through a mobile interface, ensuring quick response. The system is solar- powered, cost-effective, and easy to deploy, making it suitable for large-scale implementation. Experimental results demonstrate that the proposed system significantly improves borewell safety and reduces response time in emergency situations.

#### **689.GENERATIVE AI FOR ASSISTIVE TECHNOLOGIES AND INCLUSIVE DESIGN: OPPORTUNITIES, CHALLENGES, AND A LOW-COST STUDENT IMPLEMENTATION FRAMEWORK FOR DIFFERENTLY-ABLED USERS IN INDIA**

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Generative intelligence or GenAI for short has the potential to greatly improve assistive technologies especially for people with disabilities in areas where resources are limited. This paper looks at the opportunities and challenges of using GenAI to design products that're more inclusive with a focus on people who are blind or have low vision in India's cities and rural areas. Traditional devices that help people with disabilities are often too expensive. Do not work well in India's busy and changing environments, where there are many languages spoken and the roads are crowded. We are proposing a system that uses a low-cost prompt-driven AI agent that can work with smartphone cameras and free AI models like Google Gemini. This system can take pictures. Turn them into audio guidance that is aware of the context and speaks many languages helping people stay safe navigate and recognize objects. A group of students tested this idea. Found that it works well in many different situations in India. The results show that this system is very helpful for safety and clarity. It also has some limitations, such as problems with internet connection, incorrect information and privacy concerns. This framework shows how GenAI can help make inclusive design more accessible to everyone, which's in line with India's goals for digital inclusion and can be used as a model, for other developing countries. Index Terms. Generative AI, technologies, inclusive design, visually impaired, multimodal AI low-cost framework, India

#### **690.RAG-WEB: A RETRIEVAL-AUGMENTED GENERATION FRAMEWORK FOR INTELLIGENT WEB KNOWLEDGE EXTRACTION**

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Web-based question answering over live content fails for three compounding reasons: pages contain more structural noise than informational text, term-matching retrieval misses semantically equivalent but lexically distinct documents, and language models produce confident answers bounded by their training horizon rather than current evidence. RAG-Web addresses all three within one pipeline — Firecrawl handles automated multi-page crawling, BAAI/bge-large-en-v1.5 converts clean text into dense semantic vectors stored in Pinecone, and Llama-3.3-70B-Versatile (served via Groq) generates responses conditioned on retrieved passages rather than parametric memory. Tested on 50 queries across 10 websites, the system achieves Precision@5 of 0.81, MRR of 0.83, and mean end-to-end latency of 0.90 seconds, improving over both TF-IDF and standalone LLM baselines on every measured metric.

## **691.A LIGHTWEIGHT MULTI-MODAL TRANSFORMER ATTENTION MODEL FOR SOCIAL BOT DETECTION**

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The development of social media has caused a massive surge in automated accounts which mimic human behavior otherwise also known as social bots. Untruthful information is frequently transmitted by using these accounts, it is the way to influence the discussions online, to create the artificial activity, and these issues are the grave problems of the online platforms credibility. Current social bot detection methods are mostly based on textual analysis or user metadata separately; therefore, cannot be adequately used to identify more complicated behavioral patterns. In addition, a number of deep

learning-based approaches use heavy architectures, which require large computational efforts and reduced generalization in the confrontation of advanced bots. To solve these issues, this paper will introduce a proposal of a lightweight multimodal deep learning-based model named MTANet (Multi-Mode Transformer Attention Network) that can be effective in detecting social bots. The proposed solution collaboratively predicts complementary semantic and behavioral representations with the help of text and user metadata of tweets. Transformer-based encoder is used to generate contextual information of text, and a feedforward neural network is used to predict user-level metadata and behavioral features. These dissimilar characteristics are integrated with the help of attention-based system to represent cross-modal interactions and discriminative patterns of significant use to automated activity. It has been experimentally demonstrated that MTANet has a high detection rate and computes efficiently, supporting the efficacy of multimodal feature integration when applied through attention to attain reliable apprehension of a social media bot.

### **692.SMART SUPPLY CHAIN LEDGER PLATFORM FOR AUTHENTIC MEDICINE VERIFICATION**

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The use of counterfeit medicines in pharmaceutical chains results in considerable dangers for the consumer's health and public trust in healthcare systems. In this research, a smart supply chain ledger platform is developed for verifying the authenticity of medicines by means of digital technology. According to the concept, this innovative system will enable the registration of medicines in a ledger with the generation of production batches and QR codes that would store relevant data for authentication. These batches are encrypted using different cryptographic methods, such as SHA-256 hashes and digital signatures, to protect stored data. Consumers have two options: scan QR codes or type batch numbers using a web-based application to authenticate medicines and to obtain necessary batch data. Using cryptographic validation combined with QR-based authentication can help verify pharmaceutical products in a timely manner. This prototype demonstrates how a simple web-based system can be useful in increasing manufacturer-consumer trust and preventing counterfeit medicines.

### **693.AGRISENSE: AN INTELLIGENT AUTONOMOUS SYSTEM FOR SMART AGRICULTURE**

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The Farming industry currently has 3 main problems to deal with and get solved: a work shortage; unreliable weather patterns; and a huge push to improve food production. To solve these issues, agriculture needs technological advancements in order to increase operational efficiency. This project presents a multifunctional Agricultural Robot called "AGRISENSE" which can perform the basic tasks required to operate a farm including: planting seeds; watering plants; applying pesticides; and ploughing soil. The robot is run using an Arduino microcontroller that operates with two different types of wireless communications method Bluetooth, radio frequency (RF) and internet of things (IoT). The robot has multiple sensors that measure soil moisture content, soil temperature, moisture content, and pH value of the soil. The AGRISENSE will execute its farming operation depending on current weather conditions which will allow it to operate more than 100 % efficiently and require less manpower to run it. By implementing the model, farmers will no longer have to perform repetitive duties as a result of the increase in resource usage and the increase in their yield. The completed product will also be an affordable method to using smart agriculture to adapt to different types of agriculture.

#### **694.PRIVACY PRESERVING COLLABORATIVE MEDICAL IMAGE ANALYSIS USING FEDERATED LEARNING**

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Federated literacy has surfaced as a promising distributed machine literacy paradigm for sequestration-conserving healthcare analytics. Traditional centralized machine learning approaches require the aggregation of medical data from multiple institutions into a central server, which raises concerns related to patient privacy, data security, and regulatory compliance. Recent studies demonstrate that federated learning enables collaborative model training while keeping sensitive data localized within healthcare institutions [1], [2]. This research proposes a privacy preserving collaborative medical image analysis framework based on federated learning to improve disease detection while maintaining data confidentiality. The proposed system uses decentralized training across multiple hospitals where only model updates are shared instead of raw medical data. Several existing works have demonstrated the effectiveness of federated learning for medical image classification tasks such as pneumonia detection and cancer diagnosis [3]. In addition, privacy-preserving mechanisms such as differential privacy and secure aggregation have been integrated into federated learning frameworks to enhance security [5]. The proposed approach leverages these techniques to enable secure and scalable healthcare analytics. Experimental evaluation demonstrates that federated learning can achieve comparable accuracy to centralized models while preserving patient privacy. This study highlights the potential of federated learning for developing secure and collaborative medical image analysis systems.

### **695.EXPERIMENTAL AND MACHINE LEARNING STUDY ON CURING REGIMES AND DURABILITY OF PET FIBER- REINFORCED ROLLER-COMPACTED CONCRETE (ROCC) WITH LC3**

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This study evaluates the effect of four curing regimes normal water curing (NWC), gunny bag curing (GBC), humidity chamber curing (HCC), and accelerated curing (ACC) at 75°C on the compressive strength development of M40 Roller- Compacted Concrete (ROCC) incorporating recycled Polyethylene Terephthalate (PET) bottle fibers (1%, 1.5%, 2%) with Limestone Calcined Clay Cement (LC3) partially replacing Ordinary Portland Cement (OPC). Eight mix designs were fabricated per IRC SP-68 and tested at 7, 28, 56, and 90 days. Chemical durability was assessed under 5% MgSO<sub>4</sub> and 3% H<sub>2</sub>SO<sub>4</sub> exposure up to 90 days using compressive strength retention and specimen weight change as indices. Results confirm that the LC3 mix with 1% PET (LP1%) achieves optimum long-term performance (57.6 MPa at 90 days under NWC) and maximum chemical resistance. Three machine learning algorithms Random Forest (RF), Gradient Boosting (GB), and Artificial Neural Network (ANN) were trained on the 192-point dataset; GB outperformed with  $R^2 = 0.961$  and RMSE = 1.32 MPa on the test set.

**696.REAL-TIME NEAR-INFRARED VEIN VISUALIZATION SYSTEM USING  
IMAGE PROCESSING FOR ENHANCED VENIPUNCTURE ASSISTANCE**

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Venipuncture is a routinely performed medical procedure; however, accurate vein localization remains a significant challenge, particularly in patients with difficult intravenous access. This often leads to multiple insertion attempts, increased patient discomfort, and higher healthcare costs. This paper presents a low-cost and real-time Near- Infrared (NIR) vein visualization system to enhance the detection of superficial veins for improved venipuncture assistance. The system utilizes 850 nm NIR illumination, exploiting the higher absorption of light by deoxygenated hemoglobin compared to surrounding tissues, enabling clear visualization of subcutaneous veins. An efficient image processing pipeline is developed, including region of interest extraction, Gaussian filtering, and contrast enhancement using Contrast Limited Adaptive Histogram Equalization (CLAHE). Vein structures are segmented using thresholding and Canny edge detection, followed by morphological operations to improve vessel continuity and reduce noise. A bounding box- based approach is used to estimate vein diameter, assisting in vein selection. The system is implemented on a Raspberry Pi-based embedded platform with an infrared camera and LED array, ensuring portability and cost-effectiveness. Experimental results demonstrate improved vein visibility and reliable performance, making the proposed approach suitable for clinical and resource-limited healthcare applications.

**697.PROTOTYPE DESIGN AND DEVELOPMENT OF SMART DUAL- CHANNEL  
NASAL MONITORING SYSTEM FOR SLEEP APNEA DISORDER**

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Sleep Apnea is a prevailing sleeping disorder that is not normally diagnosed. It is defined as recurrent interruption of breathing during sleep and might result into severe health issues in case of no treatment. The conventional diagnostic tools such as Polysomnography are expensive and complex, also require overnight clinical management, which makes the treatment as less accessible for continuous or home-based monitoring. The project had exhibited a non-invasive, low-rates dual channel, nasal airflow monitoring system integrated within a wearable mask, incorporates two MPS20N0040D pressure sensors at the left and right nostrils. To analyse the changes in breathing patterns in real time, the system measures the changes in nasal pressure individually and converts them into airflow signals (L/min). Such important parameters as respiratory rate, inspiratory to expiratory (I: E) ratio, trans nasal pressure, airflow symmetry index, and obstruction status was calculated to identify instances of irregular breathing because of sleep Apnea. The dual-sensor techniques can be used to compare both left and Right nostrils and, as such, detect unilateral nasal congestion and asymmetric patterns of airflow, which was undetected in the traditional single-Sensor systems. The obtained data may be additionally combined with the signal processing or machine learning algorithms to enhance the detection rates and categorize the severity of Apnea. The system will be developed as a portable, easy to use screening device that can be applied when monitoring sleep at home, as opposed to relying on sleep studies at a hospital. It assists patients, clinicians, and researchers, through the early detection of sleep-related breathing disorders, continuous monitoring, and data-informed analysis of sleep-related breathing disorders. Overall, the suggested solution provides a cost-efficient, scalable and innovative solution to the initial diagnosis and monitoring of sleep Apnea that will lead to better respiratory healthcare and preventive medicine.

#### **698.REAL-TIME SMART BIOMETRIC ACCESS CONTROL USING MEDIAPIPE FACEMESH ON JETSON NANO**

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The traditional access control systems that use PINs and RFID cards together with 2D facial recognition technology that exhibits security weaknesses because attackers can easily spoof these systems by using photographs and recorded video footage. The research introduces a smart biometric door lock system which operates on the NVIDIA Jetson Nano platform through its dual-module system that contains user enrollment and live access control functions. The system captures facial images during enrollment which Multi- task Cascaded Convolutional Networks(MTCNN) uses to perform alignment and FaceNet generates identity vectors that get saved into a local on-device database. The authentication process uses MediaPipe FaceMesh to create a comprehensive 3D facial model which detects liveness through eye-blinking and facial depth measurements and then compares live facial data with stored identity records. The system will grant access to users only after they pass both liveness verification and recognition tests which have their individual authentication criteria. The system sends a confirmed unlock signal through Wi-Fi from Jetson Nano to ESP8266 microcontroller which controls a relay-based solenoid lock system that keeps the door shut during standard use and opens it when access gets confirmed. A web interface built on Flask software allows users to unlock doors from their smartphones which makes it easier for users with physical disabilities to operate the system. The system processes all tasks on the device because it does not require cloud services which enables quick real-time authentication while protecting all user information.

### **699.A MULTIMODAL DEEP LEARNING FRAMEWORK FOR EARLY DETECTION OF PARKINSON'S DISEASE: INTEGRATING VOICE ANALYSIS, OCULOMOTOR TRACKING, AND HANDWRITING KINEMATICS WITH IOT- ENABLED CONTINUOUS MONITORING**

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Parkinson's Disease (PD) affects over 8.5 million individuals globally, with diagnosis often occurring after substantial dopaminergic neuron loss. This paper presents a comprehensive multimodal artificial intelligence system that synergistically integrates three complementary physiological modalities—voice analysis, oculomotor tracking, and handwriting kinematics—for early PD detection. Our system employs an ensemble of gradient-boosted models (XGBoost) for voice dysphonia analysis, convolutional neural networks (CNN) for handwriting tremor detection, and MediaPipe-based heuristic scoring for oculomotor dysfunction assessment. A weighted clinical fusion engine combines these heterogeneous outputs to achieve robust diagnostic accuracy. The system achieves a weighted fusion accuracy of 94.2% on validation datasets, with individual modality accuracies of 96.8% (voice), 93.5% (handwriting), and 89.4% (eye tracking). Furthermore, we propose an Internet of Things (IoT)-integrated architecture enabling continuous, non-invasive monitoring through wearable accelerometers and ambient sensors, transitioning from episodic clinical assessment to longitudinal disease progression tracking. Market analysis reveals a total addressable market of \$2.8 billion in the digital PD diagnostics sector, with our system positioned at a 94% cost advantage over traditional diagnostic pathways. This work demonstrates that multimodal fusion significantly reduces false positives by 15% compared to single-modality approaches while maintaining high sensitivity for prodromal symptom detection.

## **700.AI-ASSISTED SURVEY DATA VALIDATION AND ANALYSIS USING AN INCENTIVIZED PARTICIPATION MODEL**

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Online surveys are widely used for data collection in research, business analytics, and decision-making processes. However, the increasing use of digital survey platforms has introduced challenges such as low-effort responses, fraudulent participation, and the lack of effective automated validation mechanisms. Most existing systems focus primarily on data collection rather than ensuring response authenticity and reliability. This paper presents an AI-assisted survey validation framework that integrates Natural Language Processing (NLP), behavioral analytics, and probabilistic modeling to

improve data quality. A novel Response Quality Score (RQS) is proposed to evaluate participant credibility by combining linguistic features, such as semantic coherence and similarity, with behavioral indicators, including response time and consistency. Additionally, Gaussian Mixture Models (GMM) are employed to cluster participants and identify anomalous response patterns. The proposed framework enables automated detection and filtering of unreliable responses, reducing the need for manual validation while preserving statistical integrity. Experimental results demonstrate improved precision and recall compared to traditional rule-based approaches. The system also exhibits scalability, making it suitable for large-scale survey environments. Overall, the framework provides a reliable and efficient solution for enhancing the quality of survey-based data.

## **701.REAL-TIME DETECTION OF SUSPICIOUS ROADSIDE OBJECTS IN SURVEILLANCE IMAGERY**

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This project develops a real-time detection system for suspicious roadside objects using deep learning. It employs a hybrid approach with Convolutional Neural Networks (CNN) for feature extraction and YOLOv8 for fast object detection. A Large Language Model (LLM) is integrated to interpret detection results and provide context-based recommendations. The system generates real-time alerts for identified suspicious objects like unattended bags or debris to improve roadside surveillance efficiency.

## **702.EFFECT OF SOIL-STRUCTURE INTERACTION AND GEOMETRIC CONFIGURATION ON STRUCTURAL BEHAVIOR**

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This paper investigates soil–structure interaction (SSI) effects on the seismic response of a G+30 reinforced- concrete (RCC) building modeled in four plan geometries (Square, L, C and T), each having the same floor area (900 m<sup>2</sup>). Analyses include equivalent static and response-spectrum procedures, with SSI represented by spring (Winkler) stiffnesses calculated for three soil conditions (soft, medium, hard). Models were prepared and analysed in ETABS to obtain modal periods, natural frequencies, lateral displacements, base shear and other dynamic response parameters. Results indicate that plan geometry and local soil flexibility significantly influence natural periods, displacements and base shear;

C and T plan geometries generally show lower lateral displacements and shorter periods (higher frequencies) compared to Square and L plans, while softer soils amplify displacements and torsional effects. The paper presents footing design, spring stiffness computations, and a discussion of response trends across soils and geometries.

### **703.A UNIFIED BENCHMARKING FRAMEWORK AND DATASET FOR EVALUATING LLM FIREWALLS AGAINST PROMPT INJECTION AND JAILBREAK ATTACKS**

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The threat of prompt injection/jailbreak attacks on production deployments of Large Language Models continues to rise. However, despite the proliferation of many commercial and open-source firewall solutions in the market, there are still no standardized frameworks to measure the effectiveness of these solutions in a real-world setting. We propose a comprehensive benchmarking system to address this issue. We have tested six prominent firewalls—Rebuff, PromptGuard, NeMo Guardrails, LlamaGuard, Trylon, and LlamaGuard2—on our benchmarking system consisting of 10,282 prompts that have been thoroughly vetted. Our benchmarking system operates entirely on Docker containers with NVIDIA RTX 5090 GPU accelerators (CUDA 12.4). Our system supports a variety of firewall architectures, ranging from simple vector matching to complex LLM-based engines. Our test dataset was created by combining publicly available research-based data from HuggingFace (deepset/prompt-injections and allenai/wildjailbreak) with over 180,000 real-world attack examples from Kaggle. We have used a custom pipeline to normalize the data set for testing. Our benchmarking system shows stark contrasts between the tested firewalls. For instance, Rebuff demonstrated an accuracy of 97.62% but allowed 31.60% of attacks to pass through, taking an average of merely 9.05ms to process each test input. However, PromptGuard scored an abysmal 26.54% accuracy with an alarming 71.09% of attacks succeeding through its system. NeMo Guardrails scored the highest accuracy of 76.03% but still allowed 66.27% of attacks to pass through its system, albeit at a whopping 368.16ms—over 40 times longer than Rebuff’s processing time. Our benchmarking system also includes a simple interactive web interface built on top of the Flask framework to allow for interactive visualization of the test results.

### **704.AUTOMATED MEDICAL WASTE SEGREGATION USING DEEP CONVOLUTIONAL NEURAL NETWORKS**

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Effective management of biomedical waste in healthcare institutions has become a challenging task with increasing generation of biomedical waste, transmission risks of infections and pollution of the

environment. In this work an automated biomedical waste classification system is designed by implementing a Deep Convolutional Neural Network (DCNN) for real-time classification of biomedical waste image into four color-coded bins (Red, Blue, White and Black). 10472 images are acquired from Kaggle dataset, which are pre-processed using Multi-Scale Retinex with Color Preservation (MSRCP) for image enhancement, Gaussian filter for noise reduction and pixel normalization. After training DCNN model, the obtained testing accuracy is 87.49%, where the achieved precision, recall and F1-score values are 0.88, 0.87 and 0.87 respectively. The classified output is sent using Wi-Fi to ESP32 micro-controller where the output values are transmitted to servo motors to sort waste into their appropriate color-coded bins. A web-interface is designed for image upload and real-time web-cam based classification. Our experiments with the developed system are carried out for all types of waste in normal and low lighting condition and the reliable and flexible system is successfully developed to effectively manage the biomedical waste in health care sectors.

### **705.MEDSCAN: A SEQUENTIAL MULTI-AGENT LLM ARCHITECTURE FOR AI-POWERED MEDICAL REPORT ANALYSIS AND PATIENT HEALTH COMMUNICATION**

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The growing volume of diagnostic reports issued to patients in modern healthcare systems has created a persistent information accessibility gap. Medical documents containing clinical terminology, reference ranges, and biomarker values are routinely delivered to individuals who lack the medical training required to interpret them. This paper presents MedScan, a full-stack AI-powered health report analysis and patient communication platform that addresses this gap through a novel sequential seven-agent Large Language Model (LLM) workflow. Each agent is assigned a single clearly-scoped analytical responsibility — spanning structured data extraction, clinical significance classification, medical interpretation, plain-language simplification, structured summarization, terminology definition, and longitudinal data structuring — following modular design principles analogous to SOLID software engineering. The platform additionally provides longitudinal biomarker trend visualization, a context-aware conversational chatbot, patient-controlled secure report sharing, and a plug-and-play hospital integration model enabling institutional deployment without EHR integration. A privacy-first, six-layer security architecture supports HIPAA and GDPR compliance with patient data sovereignty as a foundational design principle. Evaluated on 150 anonymized reports across four report types, MedScan achieves a Flesch-Kincaid Grade Level (FKGL) of 6.1 (vs. 9.4 for single-prompt baseline), factual consistency of 4.3/5.0, non-diagnostic compliance of 96.7%, and extraction F1 of 0.89, substantially outperforming both baselines across all metrics.

### **706.REAL-TIME SEIZURE PREDICTION: A SNEAK PEEK**

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Seizures are neurological illness that tend to affect people with epilepsy. They are triggered due to rapid, extreme, or erratic electrical impulses from the brain that cause disruption with normal cognitive function and gradually impact negatively the affected individual's ability to process information and behave normally. Although they can end up in involuntary movement, a loss of sense of awareness and agitation, and in cases of extreme severity, even death, seizures can have a severe adverse impact effect on a person's capacity to sustain a healthy state, self-reliance, and overall quality of lifestyle. Since seizures are unavoidable, the person who is at a high risk of having experiences with chronic anxiety, affecting routine activities notably more complex and/or hazardous. A number of characteristics, including presence of intense amplitude spike-wave discharges and uneven rhythmic fluctuation, are commonly incorporated into the classification of seizures. The brain's electrical activity can be studied using a variety of monitoring methods, includes EEG signals. There will be more chances to prevent a seizure through a variety of approaches, such as early medical treatment, listening to the person at risk when they have a seizure, by setting up a safe environment, as soon as a seizure pattern can possibly be observed or detected. Thereby, providing healthcare professionals the most recent and accurate data related to patient seizure activity, monitoring and assessment of electroencephalogram signals is vital to the entire development of treatment for seizure patients. Several EEG based procedures for recognizing seizures and prediction now in use are thoroughly investigated in this article.

#### **707.A SUSTAINABLE HYDROGEN GENERATION SYSTEM**

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The research highlights a hydrogen fuel cell generator that relies on an electrolytic chemical reaction fuelled by water and a chemical called potassium hydroxide as an electrolyte in a glass container. The setup relies on a 12V energy source and two steel electrodes placed in the chemical mixture of potassium hydroxide and water ( $\text{KOH} + \text{H}_2\text{O}$ ), which triggers a chemical reaction that yields hydrogen fuel. The hydrogen fuel is expected to play an important role in achieving the objectives of renewable energy sources and is touted as a clean fuel alternative for energy production. The inclusion of tables and figures that present the setup and findings would aid in improving the outcome of this study.

### **708.SMARTPAY - SECURE DIGITAL TRANSACTIONS WITHOUT INTERNET**

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This paper explains the design and implementation of a secure hybrid digital payment system that combines online and offline transaction capabilities. The system integrates ideas from financial technology, mobile computing, and secure distributed systems. It allows smooth peer-to-peer transactions even in areas with low connectivity. Unlike traditional digital payment platforms that require constant internet access, this system uses an offline payment method that relies on Bluetooth Low Energy (BLE) communication and delayed synchronization. The system's architecture includes a mobile client built with React Native and a backend server created with Node.js and Express.js, along with a lightweight database. It offers OTP-based authentication, wallet management with online and offline balances, bank account linking, and transaction tracking. Secure transaction processing uses cryptographic techniques, including public key encryption, digital signatures, and nonce-based validation to prevent replay attacks. A major contribution to this work is the offline transaction module. This feature enables users to transfer funds using Bluetooth when there is no internet connection. These transactions are stored locally and synced with the central server once the connection is restored to ensure data consistency and reliability. The system also supports hybrid wallet transfers, allowing users to easily move funds between online and offline balances. Experimental tests show that the system maintains transactional integrity, reduces the need for constant network availability, and provides a scalable solution for rural areas and places prone to disasters. This proposed solution could help improve financial inclusion, facilitate emergency payments, and develop the next generation of offline digital payment systems.

### **709.NEETHIVAAN: AI-POWERED LEGAL GRIEVANCE & AWARENESS PLATFORM**

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Access to justice remains a challenge for many citizens due to limited legal awareness, complicated complaint procedures, and lack of guidance in understanding legal processes. Many individuals struggle to identify the appropriate legal sections applicable to their cases and often face delays in registering complaints or seeking assistance, while traditional legal support systems require manual consultation with legal professionals, making them expensive and time-consuming. This paper proposes Neethivaan, an AI-driven legal awareness and complaint assistance platform designed to simplify legal guidance and improve accessibility to justice services. The system enables users to register complaints digitally by providing case details and descriptions, which are analyzed using Natural Language Processing (NLP) and case similarity techniques. The AI engine compares the complaint with relevant legal provisions and previously solved cases to generate suggestions for applicable laws, legal sections, and recommended actions. Users can review and select relevant suggestions, after which the system performs re-analysis to generate a structured legal guidance report. The platform also supports FIR/CSR number generation for case registration and provides real-time complaint tracking. Additional features include an AI-powered chatbot, a legal awareness portal, and multilingual support to ensure accessibility for diverse users. The proposed system aims to enhance legal awareness, reduce procedural complexity, and empower citizens with intelligent and guided legal assistance.

## **710.DESIGN OF A HYBRID LOW POWER DADDA MULTIPLIER USING GDI LOGIC IN FINFET TECHNOLOGY**

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Multipliers are among the most power-hungry blocks in digital signal processing, image processing, and high-performance computing and conventional designs make this worse with high transistor counts and excessive switching activity. This paper presents an  $8 \times 8$  Dadda multiplier implemented in 18nm FinFET technology, combining Gate Diffusion Input (GDI) logic with standard CMOS to address the dual challenge of power consumption and operating speed. GDI-based AND gates handle partial product generation, while hybrid half adders and full adders drive the reduction tree. The Dadda algorithm keeps the number of reduction stages to a minimum, which directly shortens the critical path and improves timing. The design was built and verified at the schematic level in Cadence Virtuoso, with transient simulations run across multiple input combinations to confirm correct output behavior. Compared to existing hybrid multiplier designs, the architecture delivers lower power consumption, reduced propagation delay, and an improved power-delay product. These characteristics make it a practical candidate for VLSI systems where both power efficiency and speed are hard requirements.

## **711.GEOMETRIC NONLINEAR ANALYSIS OF STEEL MINE HEADGEAR STRUCTURES UNDER MBS-BASED HOISTING AND COMBINED LATERAL LOADS**

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Mine headgear structures support the hoisting systems where the high vertical loads are transferred from the wire rope through sheave platform. As mine depth as well as the payload capacity increase, the accurate prediction of the structural deformation as well as stress becomes essential for ensuring the safe operation. The conventional design often relies on the linear static analysis which does not fully represent the response of slender headgear towers when the large hoisting loads are applied. This study evaluates the static behavior of steel four leg mine headgear using the hoisting loads derived from the minimum breaking strength of the wire rope. The linear as well as the nonlinear geometric analyses were performed to quantify the displacement, stress distribution, as well as the joint performance under the different loading conditions. The additional lateral forces were introduced to examine the combined loading effects where the critical response zones were identified. The results show that nonlinear analysis predicts 29 to 32 percent increase in the lateral displacement at the sheave level compared with linear estimates. The member stresses increased by approximately 15 to 20 percent, while the joint stresses in the bolted as well as welded connections rose by nearly 20 percent under the extreme combined loading. The interaction between vertical as well as the lateral loads produced the highest deformation as well as stress demand. The study highlights the need to incorporate the nonlinear geometric analysis in headgear design as well as the verification. The proposed modeling approach provides the practical framework for evaluating the load amplification as well as connection behavior under the realistic hoisting conditions.

## **712.HOUSE PRICE PREDICTION USING MULTI-SOURCE DATA FUSION AND ENSEMBLE LEARNING TECHNIQUES**

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Estimating home values can be a difficult process, based upon many factors (i.e., home characteristics, location, amenities, and infrastructure surrounding the property). Traditional methods typically rely on a limited number of attributes and linear models, inadequately capturing the nonlinear relationships that exist in the real world. Therefore, this paper proposes a sophisticated framework to predict home values using machine learning-based technology, by utilizing multiple data sources through data fusion and applying ensemble learning methodologies. The dataset is extensive in that it consists of a wide array of attributes such as structural characteristics, geographic coordinates, and accessibility indicators from nearby amenities. A large preparation of the data has been accomplished, including data cleaning, feature engineering and the conversion of the dependent variable into its logarithmic value to overcome skewness. A number of new features have also been introduced to enhance the overall model performance, such as property age, total number of rooms and accessibility scores. Several machine learning models were developed including Random Forest, XGBoost and LightGBM. Each model has been optimized through hyperparameter tuning to further improve accuracy levels. A stacking ensemble was developed that utilized CatBoost as the meta-learner, which allowed for the integration of all three models providing a new model with enhanced predictive capabilities. The end results of the model indicate that the overall  $R^2$  value of the new stacking model was 0.9115 or an improvement over the other models. A complete web application has also been developed that provides real-time updates.

### **713.STUDY ON THE MECHANICAL AND DURABILITY PROPERTIES OF ZEOLITE AND POLYVINYL ALCOHOL (PVA) FIBRE ON CONCRETE**

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The results of this investigation on the mechanical and durability characteristics of SCC concrete, including zeolite and PVA fibre. Zeolite exhibits pozzolanic properties, which react with calcium hydroxide to produce additional C-S-H gel, making it suitable as a supplementary cementitious material in SCC concrete. It's applied as a partial replacement in different percentage and 10% is determined as optimum. Utilisation of zeolite leads to a decrease in cement content and eco-friendly & sustainable concrete. Fibres are added to SCC concrete to enhance crack resistance. In the present study, Poly Vinyl Alcohol (PVA) fibre offers a superior bonding and crack control characteristic, which is added in different percentages (0.8%, 1.0% and 1.2%) to examine its influence on the properties of SCC. To evaluate its strength, tests including compression and flexure, similarly evaluate its durability, water absorption test, followed by acid attack test, are carried out. Standard cube specimens of size  $150 \times 150 \times 150$  mm and prism specimens of size  $100 \times 100 \times 500$  mm are cast and tested as per standard practices. The results obtained are employed to assess the effect of Poly Vinyl Alcohol (PVA) fibre addition on the strength and durability properties of SCC partially replacing zeolite, and to draw suitable conclusions.

## **714. AN INTEGRATED AI FRAMEWORK FOR SMART GRID FORECASTING, OPTIMIZATION, AND PREDICTIVE MAINTENANCE**

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The increasing penetration of photovoltaic (PV) generation introduces coupled challenges related to renewable forecasting uncertainty, energy storage scheduling, and equipment degradation. Conventional smart grid solutions address these problems independently, resulting in fragmented decision-making, increased curtailment, and reduced asset lifetime. This paper proposes an integrated artificial intelligence (AI) framework that unifies high-resolution renewable energy forecasting, optimal battery energy storage scheduling, and predictive maintenance within a single operational architecture. A bidirectional long short-term memory (Bi-LSTM) network with exogenous attention is employed for probabilistic solar forecasting, while forecast uncertainty is propagated into a multi-objective genetic algorithm (GA) for robust storage scheduling. Isolation forest-based anomaly detection is incorporated for inverter predictive maintenance. The framework is deployed within an IEEE 2030.5-compliant edge-fog architecture and achieves sub-500 ms end-to-end latency. Validation using three years of 1 Hz NREL Solar Radiation Research Laboratory data demonstrates 3.2% NRMSE for 15-minute forecasting, 18.7% operational cost reduction, and 94.3% precision for 72-hour failure prediction.

## **715. NEXIS ERP AI-DRIVEN PREDICTIVE WORKFLOW AUTOMATION SYSTEM**

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Enterprise Resource Planning (ERP) systems are indispensable tools in business operations. Their primary role is to integrate the functions of various departments such as sales management, inventory control, procurement, and financial accounting. NexisERP, a proposal of this article, is an enterprise-level planning software enhanced with AI capabilities. It is built on the combination of machine learning-based demand forecasting, unified workflow management, and reasoning with large language models (LLM) for enterprise management that is both intuitive and predictive. Fundamentally, the framework is guided by the forecasting-first stance, in which machine learning techniques are used to analyse the sales data from the past and to forecast the future sales. The enterprise activities such as production planning, inventory audits, supplier sourcing, and financial approvals, etc. are, eventually,

the outcomes of these forecasts. Different ERP modules' interaction is made through a central orchestration unit that instructs them how to work. As a result, enterprise decisions are not only consistent but also executed concurrently in different modules. On top of that, introducing intelligence through an LLM turns into a layer that, firstly, explains the workflow in a very human way, secondly, reveals the key points of the workflow, and finally, based on the structured outputs of the ERP modules, suggests decisions that are understandable. Integration of forecast demand with automatic workflow coordination as evidenced by trial runs indicate that it can drastically enhance enterprise planning both in terms of flexibility and explanation of the decisions made by natural language. The paper is about the possibility of the current AI methods to upgrade ERP platforms from being mere systems for transaction processing to being proactive decision support environments for enterprises.

### **716.DESIGN AND ANALYSIS OF HFO 2 /AL 2 O 3 /HFO 2 TRILAYER-BASED RESISTIVE RAM**

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The demand for next-generation nonvolatile memories has been increased due to the quick development of intensive applications like artificial intelligence and neuromorphic computing. Traditional Flash memory faces slower switching speed and higher operating voltage, while conventional volatile memories such as SRAM and DRAM have scaling restrictions. Resistive Random Access Memory (RRAM) has gained popularity due to its structure and compatibility with CMOS technology. A trilayer HfO<sub>2</sub>/Al<sub>2</sub>O<sub>3</sub>/HfO<sub>2</sub> RRAM structure with TiN and Pt as electrodes is designed and analyzed in this work using Synopsys TCAD Sentaurus. The Al<sub>2</sub>O<sub>3</sub> layer acts as a tunneling barrier layer to reduce leakage current and improve switching stability. The simulation part uses physical models like electron barrier tunneling and thermodynamic effects to capture the filament dynamics. The captured results shows stable bipolar switching behavior, and controlled filament formation providing a solid base for upcoming applicational implementations.

### **717.SUSTAINABLE DAM BREAK FLOOD INUNDATION MAPPING AND EIA USING QGIS, HEC-RAS AND HEC-HMS**

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The catastrophic potential of dam failure necessitates advanced predictive modelling to safeguard downstream ecosystems and infrastructure. This study develops a sustainable, integrated framework utilizing HEC-HMS for hydrological inflow generation, HEC-RAS for 2D hydrodynamic flood routing, and QGIS for multi-criteria Environmental Impact Assessment (EIA). By leveraging high-resolution Digital Elevation Models (DEM) and Sentinel-2 satellite imagery, the model simulates breach development and routes the resulting flood wave using Shallow Water Equations (SWE). A unique “Sustainable Vulnerability Index” is introduced within the QGIS environment to quantify ecological and socio-economic degradation. The results demonstrate that this open-source pipeline

provides a high-fidelity, cost-effective alternative to proprietary software, enabling resilient disaster risk management in resource-constrained regions.

### **718.CORROSION PROGRESS MONITORING IN REINFORCED CONCRETE STRUCTURES: MECHANISMS, TECHNIQUES, AND ADVANCEMENTS**

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Corrosion of steel reinforcement remains one of the most critical challenges affecting the durability and service life of reinforced concrete structures, leading to significant safety risks and economic losses worldwide. This paper presents a comprehensive review of corrosion progress monitoring in reinforced concrete, focusing on electrochemical mechanisms such as chloride-induced and carbonation-induced corrosion, along with the formation of expansive corrosion products that cause internal stresses and structural deterioration. The study evaluates conventional electrochemical techniques and advanced non-destructive testing methods for corrosion assessment. It further explores emerging technologies, including artificial intelligence-based crack detection, IoT-enabled monitoring systems, and self-healing concrete for autonomous repair. The limitations of current monitoring practices, particularly the differences between laboratory simulations and real field conditions, are also discussed. This review highlights the need for integrated monitoring approaches and supports the development of intelligent infrastructure systems for improved durability and maintenance

### **719.VLSI IMPLEMENTATION OF MULTIMODE IMAGE PROCESSING ALGORITHMS USING FPGA**

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In this paper, we describe the design of a real- time photo enhancement system in Verilog code that will run on FPGA. Our proposed method is able to process RGB photos pixel by pixel using a pipeline architecture. It is capable of processing two pixels per clock cycle while simultaneously transmitting

VSYNC and HSYNC signals as the system has a finite state machine (FSM). Among the three types of photo enhancements that do not need many computational efforts, there are binary thresholding, inversion of the picture, and brightness adjustment with varying levels of brightness and saturation. All three processes take place in the RGB colour space and proper clipping ensures that the values remain within the limits of 8 bits [0, 255].

## **720.REVIEW ON PREPARE AND TEST HOLLOW SLAB WITH ECONOMICAL COMPARISON**

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Slab systems happen to be the most material-demanding parts in a reinforced concrete building and their proper functioning is important for the structural safety, serviceability, and cost, and energy efficiency. Though widely considered and the solid conventional reinforced concrete slabs have consumed big amounts of concrete and steel, heavier dead loads are their outcome and there is an increased load on the beams, columns, and foundations as well. Over the last few decades, hollow and voided slab systems, such as hollow-core slabs, bubble deck slabs, and voided flat slabs, have been viewed as sustainable solutions because they need less material and their structural efficiency is better. This review paper provides a thorough synthesis of recent research on hollow slab technologies focussing on structural behaviour, flexural and punching shear performance, deflection features, construction methods, strengthening techniques, and economic viability. The literature's experimental, numerical, and analytical studies are rigorously analyzed to discern the advantages, limitations, and performance trends of the different hollow slab systems. Furthermore, the paper indicates the present research gaps concerning code provisions, long-term behavior, and system-level cost evaluation. By reviewing the literature, the authors want to provide support for engineers and researchers in their endeavors to choose and optimize hollow slab systems for constructing safe, cost- effective, and energy-efficient buildings.

## **721.IMPROVING DEVANAGARI HANDWRITTEN WORD RECOGNITION USING CRNN-CTC WITH DUAL-ENGINE INFERENCE**

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Recognition of handwritten Devanagari words remains a tough problem due to the difference in writing styles, intricacy of character structures, and presence of ligatures. This work presents a robust end-to-end handwritten Devanagari word recognition system using CRNN with CTC loss, which performs preprocessing, dynamic segmentation and sequence modeling for segmentation-free recognition. Dual engine inference using CRNN and Tesseract OCR along with dictionary-based post-processing is adopted to ensure accuracy and robustness. Experimental results indicate that the suggested model reaches a word accuracy of 85.8% with a CER of 3.53%, outperforming existing machine learning based models like SVM (baseline 90.6% on feature-based models) and traditional OCR systems. The proposed approach serves as a robust and scalable solution for practical document digitization and regional language processing.

## **722.ENVIRONMENTAL RISK PREDICTION USING EMBEDDED MULTI-SENSOR SYSTEMS WITH TINYML**

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Environmental risks like air pollution, gas leakage, fire, and structural instability are major risks to human lives. The current methods of predicting environmental risks make use of cloud computing systems. However, these systems are associated with latency, high bandwidth, and continuous internet connectivity. This paper proposes an innovative approach to predicting environmental risks by making use of TinyML-based embedded multi-sensor systems. The proposed approach will make use of various sensors like air quality sensors, vibration sensors, sound sensors, temperature sensors, and humidity sensors. The proposed approach will be based on a microcontroller unit with TensorFlow Lite for Microcontroller. This will enable machine learning inference on the device. This will enable real-time prediction of hazards without relying on cloud connectivity. This will enable low latency, high reliability, and high data privacy. Furthermore, the proposed approach will be based on sensor data fusion and real-time correction for enhanced accuracy. The proposed approach will be cost-effective and can be applied to various applications.

## **723."A HYBRID ATTENTION-GUIDED VISION TRANSFORMER AND GRAPH NEURAL NETWORK FRAMEWORK FOR MULTI-CLASS BRAIN TUMOUR SEGMENTATION AND CLASSIFICATION FROM MULTI- MODAL MRI SCANS"**

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In this paper, we propose an intelligent deep learning approach to improve the detection and interpretation of multi-class brain tumours by MRI imaging. Our model combines two powerful new technologies — Vision Transformers, which are good at understanding the overall picture, and Graph Neural Networks, which pay close attention to the details and how different parts of the brain relate to each other. We also employ an attention mechanism to combine features of various MRI types (e.g., T1, T1c, T2 and FLAIR) such that the model pays more attention to what is most relevant. Benefiting from this strategy, our model was able to surpass state-of-the-art methods in detecting and classifying brain tumours in commonly seen medical examinations, showing potential for clinical use. Index Terms—Brain tumour classification, magnetic resonance imaging (MRI), vision transformer, graph neural networks, multimodal MRI fusion, attention mechanism, deep learning, computer-aided diagnosis

## **724.EV CHARGING STATION USING SOLAR AND LOAD BALANCING**

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A microcontroller-based control unit monitors solar power generation, battery status, and vehicle charging requirements in real time. In the event of insufficient solar power, the system automatically switches to the grid supply while ensuring optimal load distribution through load-balancing algorithms. This approach minimises power wastage, prevents grid overloading, and enhances overall system efficiency. A smart charging system optimises the use of solar energy and manages the charging sessions to avoid peak demand periods. We describe the system design, implementation, and benefits of a solar-powered EV charging station.

## **725.INTELLIGENT MOTION-COMPENSATED STRETCHER WITH REAL-TIME PITCH-ROLL DYNAMICS CONTROL**

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The need for precise engineering to negate the associated risks is paramount in today's emergency medical environment, be it the risks in the safe transit or the critical support care at the patients bed. This research paper outlines the design, development and implementation of an IoT enabled dual-axis self-balancing stretcher developed for the rugged conditions associated with both vibration and high inclination that are encountered in emergency transportation of the critically ill. This project is grounded in the realization that hitherto the traditional passive design of the stretcher and equipment that has hitherto come to ubiquity, has neither taken into account the physical laws that lead to centrifugal acceleration, the physical laws involved during emergency application of brakes, nor the very extreme effects resulting from inclined surfaces and terrain upon dynamic load resulting in secondary injuries or, indeed, failure of essential bed side patient care techniques. The fundamental technology involved in the working of the system is ESP32 microcontroller a dual-core unit chosen due to its fast clock-rate and integrated Wi-Fi communications stacks. The latter enables real-time controls communications and cloud enablement. This controller is coupled with a MEMS-based MPU6050 Inertial Measurement Unit (IMU) sensor consisting of a 3-axis accelerometer and a 3-axis gyroscope providing a 6 Degree Of freedom orientation vector. The resultant electronics signal is converted into physical motion by two MG996R high torque servos arranged on a dual-axis gimbal providing rapid movement in pitch (front to back) and roll (side to side) to maintain an extremely stable and earth parallel to the gravitic plane patient platform. The software development aspect of the project has put considerable focus on signal filtration and stability. The MEMS sensor naturally prone to high frequency noise and oscillation as is itself subject to mechanical oscillation induced by the vehicle motor or indeed the servos. To circumvent this phenomenon an exponential moving average (EMA) filter of high order was implemented along with a special deadzone control for each of the servos so as to minimize "servo hunting" and jitter, enabling extremely fluid and smooth motion to ensure patient comfort. The Auto-Calibration and Zero offset routine at initial startup establishes a "parallel-home position" relative to the gravitational plane regardless of initial mounting orientation of the vehicle stretcher system.

## **726.AGRIDEAL AI — SMART NEGOTIATION FOR FARMERS TRADERS & LET AI BARGAIN YOU JUST APPROVE OPTIMIZED NEGOTIATIONS, MAXIMUM RETURNS**

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Agricultural trade remains one of the few sectors where critical economic decisions are still driven by informal, face-to-face bargaining rather than data-driven intelligence. Millions of farmers and traders continue to negotiate prices without access to real-time market insights, strategic negotiation tools, or transparent transaction systems, resulting in persistent income loss and systemic market inefficiencies. This paper presents AgriDeal AI, a next-generation intelligent negotiation platform designed to fundamentally transform agricultural commerce. The platform deploys autonomous AI bargaining agents, real-time market intelligence, and advanced Operations Research optimization models to replace traditional agricultural haggling with precision-driven, algorithmic deal-making. AgriDeal AI integrates Linear Programming, Game Theory, Dynamic Programming, Reinforcement Learning, Queuing Theory, Multi-Criteria Decision Making, and Time Series Forecasting into a unified trade automation framework. This architecture enables the system to determine optimal price ranges, strategically negotiate with buyers, adapt dynamically to market behavior, and evaluate competing offers based on multiple economic criteria. System modeling and theoretical evaluation demonstrate that AgriDeal AI significantly improves price realization for farmers, reduces negotiation time, eliminates information asymmetry, and introduces a fully transparent digital transaction ecosystem. By combining artificial intelligence with rigorous optimization techniques, AgriDeal AI establishes a new paradigm for agricultural trade—one that empowers rural producers with the same sophisticated decision-making capabilities traditionally available only to large market participants. The platform represents a decisive step toward equitable, efficient, and intelligent agricultural markets, positioning AI-driven negotiation as a critical innovation for the future of global food supply chains. The future of agricultural commerce is not at the marketplace. It is online, it is optimized, and it is already here.

## **727.SECURE APPLICATION FRAMEWORK FOR RUN TIME TAMPER DETECTION**

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Application tampering, It is one of the most important security problems in modern software systems, where attackers attempt to modify application code in order to bypass protections, or add malicious functionality. The given paper offers a Secure Application Framework of Runtime Tamper Detection to provide software integrity with the help of client-server architecture. The client keeps on producing cryptographical hash values of the key components of the application and they are sent to a central verification server. These values are compared with known reference hashes by the server in a database. Any deviation is viewed as an act of interference and documented so as to be evaluated. The system recognizes the identifications of the authentications of tokens and secure communication paths are also utilized to sustain safe data communication. Experimental results show that the framework is capable of identifying the existence of illegal changes in real time at a minimal performance cost.

## **728.DUAL-MODALITY BRAIN IMAGE FUSION: A COMPARATIVE STUDY OF PCA AND NSST-PCNN APPROACHES FOR ENHANCED MRI-PET DIAGNOSTIC VISUALIZATION**

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Medical image fusion enables modern clinical diagnosis through its ability to merge different imaging techniques into one comprehensive picture. The research evaluates two different image fusion methods which researchers tested on both Magnetic Resonance Imaging (MRI) and Positron Emission Tomography (PET) scans. The first proposed method uses Principal Component Analysis (PCA) as its statistical method which applies dynamic weighting to input images through eigenvalue decomposition to produce fused output image that contains more structural information. The second existing method uses Non-Subsampled Shearlet Transform (NSST) with Pulse Coupled Neural Network (PCNN) as its base for its advanced fusion system. The evaluation of both methods uses five different metrics which include Peak Signal-to-Noise Ratio (PSNR) and Structural Similarity Index (SSIM) and Entropy and Standard Deviation and Mutual Information [7], [9], [10]. The experimental results show that the

proposed PCA approach produces diagnostic reliable fused images through its computational efficient method while NSST+PCNN requires more processing power to achieve higher entropy results [9], [12], [15].

## **729.EXPLAINABLE CERVICAL SPINE FRACTURE DETECTION USING DENSENET121 WITH ATTENTION MECHANISM ON CT IMAGES**

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The cervical spine injuries are severe fractures that need fast and precise diagnosis in order to avoid serious neurological issues. Computed Tomography (CT) is very popular, and the large number of slices is time-consuming and subject to error, especially when analyzed manually. This paper has offered an explicable deep learning model of automatic fracture detection based on CT images. To enhance the patient-level prediction, the model uses a DenseNet121 backbone and a slice aggregation mechanism by attention to enhance patient-level prediction. ImageNet transfer learning helps improve the feature representation, whereas Grad-CAM is able to be interpreted by highlighting clinically significant areas. The model is tested on the RSNA cervical spine fracture dataset which has 2019 patient studies. Findings have shown better results on top of the baseline models like ResNet50 and the standard DenseNet121. In general, the framework gives an effective and explainable solution to the computer-aided fracture diagnosis. Index Terms—Cervical spine fracture detection, computed tomography (CT), deep learning, DenseNet121, attention mechanism, transfer learning, Grad-CAM, medical image analysis.

## **730.A COMPREHENSIVE REVIEW OF EV CHARGING STATION SCHEDULING: OPTIMIZATION TECHNIQUES, RENEWABLE INTEGRATION, AND FUTURE DIRECTIONS**

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The rapid penetration of electric vehicles (EVs) is significantly transforming modern transportation and power systems. However, uncoordinated EV charging can create severe challenges such as peak demand increase, higher charging cost, long waiting time, and grid instability. Therefore, EV charging station scheduling has emerged as an important research area in smart grids and sustainable transportation systems. This paper presents a concise review of EV charging station scheduling with emphasis on charging infrastructure, scheduling problem formulation, optimization techniques, renewable energy integration, research challenges, and future directions. The review covers mathematical optimization, meta-heuristic algorithms, artificial intelligence-based methods, and hybrid approaches. In addition, a standardized comparative analysis is presented using common performance indicators such as cost reduction, waiting time reduction, peak load reduction, renewable energy

utilization, real-time suitability, and scalability. The results indicate that while mathematical optimization methods remain effective for deterministic scheduling problems, artificial intelligence and hybrid optimization methods are more suitable for uncertain, real-time, and renewable-integrated charging environments. This review provides a compact and practical reference for researchers working in EV charging optimization and smart energy systems.

### **731.EASY FAULT DETECTION IN RADIO-OVER-FIBER MIMO SYSTEMS WITH MACHINE LEARNING**

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The integration of wired and wireless networks using Analog Radio-over-Fiber (A-RoF) technology is critical to the 5G fronthaul and distributed antenna systems. Although A-RoF technology enables simplified remote node design by transmitting RF signals directly over optical fibers, the use of analog components such as optical transmitters, optical fibers, and photodetectors makes these systems susceptible to performance degradation. The current state-of-the-art solutions employ Support Vector Machines (SVM) for hardware-agnostic fault detection ; however, these solutions are restricted to binary classification, do not support fault localization, and employ basic ratios of singular values, which can be inadequate to capture nonlinear distortions. In this context, this paper presents a Hybrid Adaptive Voting Intelligence Framework. We combine a Deep Autoencoder for nonlinear feature compression of MIMO channel matrices, including amplitude, phase, and singular vectors to offer a more comprehensive representation than basic singular values. The classification task is done using a margin-based SVM, while a Bayesian Probabilistic Voting system dynamically adjusts the classification confidence based on the fault probability rates. Additionally, we present a fault localization module that leverages feature attribution mapping from reconstruction error gradients to point to the individual component failures in the analog chain.

### **732.A SUSTAINABLE EDGE INTELLIGENCE FRAMEWORK: CO-OPTIMIZING QUANTIZATION AND SLEEP-SCHEDULING FOR IOT**

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The usage of IOT (Internet Of Things) in various technologies and environments has increased the need for efficient and smart processing of data before sending it to the network. This allows for reduced response time and reduced dependence on cloud infrastructure. But using artificial intelligence (AI) operations on edge devices that already has small resources generates critical challenges related to energy efficiency, computational constraints, sustainability, and long-term device operation. In recent trends usage of TinyML and edge AI solutions are used to optimize either model efficiency through compression techniques or device power management through duty-cycling mechanisms, often disregarding the effects of computation, communication, and environmental sustainability across the system. Resulting in overall inefficient energy utilization particularly in large-scale IoT systems by relying on battery-powered microcontrollers. This paper proposes a sustainable edge intelligence framework that jointly optimizes neural network quantization and adaptive sleep scheduling within an integrated energy-aware architecture. This framework converts the default ai model parameters into 8 bits to reduce model size and computational complexity while incorporating a sleep-aware scheduling strategy that dynamically regulates active, idle, and low-power states depending on the sensing workloads and communication demands. In addition, it also integrates low-power wide-area network (LPWAN) communication support, energy harvesting awareness systems, and on-device carbon estimation modules to enable environmentally conscious edge computing. Also, a lightweight intrusion-detection pre-filter system is embedded in this system to enhance the operational security with minimal energy consumption. A comprehensive analysis based on literature between 2021 and 2025 shows gaps in energy optimization, sustainability assessment, and secure TinyML deployment. This is systematically addressed in this paper through the proposed co-optimization strategy. Experimental validation has been performed using both simulations and real hardware platforms like STM32F407 and ESP32-C3 micro-controllers demonstrating substantial improvements in conventional edge AI implementations. These results show significant reductions in total energy consumption and the notable extension of device battery lifetime and decrease in operational carbon footprint while maintaining high inference accuracy for multi-modal urban sensing applications. This framework advances the development of green and sustainable AI by enabling scalable, energy-efficient, and secure edge intelligence for next-generation IoT ecosystems.

### **733.DEEP NEURAL NETWORK MODEL FOR HEART DISEASE PREDICTION THROUGH RETINAL MICROVASCULAR FEATURES**

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Cardiovascular diseases are among the leading causes of death worldwide, often developing silently without noticeable symptoms in their early stages. Early detection plays a crucial role in reducing risk and improving patient outcomes. This project presents an intelligent system for predicting heart disease using retinal fundus images with the help of Convolutional Neural Networks (CNN). The retina contains a network of blood vessels that reflects the condition of the body's microvascular system, making it a valuable source for identifying cardiovascular abnormalities. In this work, retinal images are collected and preprocessed to enhance quality and remove noise. A deep learning model based on CNN is then designed to automatically extract important features such as vessel thickness, branching patterns, and irregularities. These features are analyzed to classify whether a person is at risk of heart disease or not. The model is trained and tested on a dataset of retinal images to ensure accurate and reliable predictions. The proposed system offers a non-invasive, cost-effective, and efficient approach for early diagnosis compared to traditional methods. It reduces the dependency on complex medical tests and expert interpretation. Experimental results show that the CNN-based model achieves promising accuracy in detecting cardiovascular risk, highlighting its potential use in real-world healthcare applications. This approach can support doctors in decision-making and contribute to preventive healthcare by enabling early intervention.

### **734.FEMLYTIX: AI-DRIVEN PCOS & PCOD PREDICTION BEYOND CLINICAL BOUNDARIES**

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Polycystic Ovary Syndrome (PCOS) and Polycystic Ovary Disorder (PCOD) are common hormonal disorders affecting a large number of women worldwide, often leading to complications such as irregular menstruation, infertility, and metabolic issues. One of the major challenges with PCOD/PCOS is the difficulty in early detection due to overlapping symptoms and the dependence on lab tests for

diagnosis. This project aims to develop an AI-powered web application that assists both doctors and patients in the early-stage prediction and differentiation of PCOS and PCOD based on non-invasive, pre-laboratory physiological parameters and self-reported symptoms such as menstrual data (Number of peaks, length of cycle, etc.) and Personal data (Weight, Height and Age). Machine learning algorithms are employed to classify individuals based on risk and probable condition. Based on the severity and predicted condition, the platform will also generate personalized diet and lifestyle recommendations to manage the condition effectively. Additionally, the system will flag high-risk individuals and advise them to seek immediate medical consultation. The web app will feature an intuitive interface, support secure data handling, and aim to bridge the diagnostic gap by providing an affordable, accessible, and intelligent health screening tool. Through this platform, the project seeks to empower users with early insights, promote self-care, and support healthcare professionals with valuable decision-making assistance.

### **735.ATTENTION-ENHANCED BILSTM FOR GROUND-LEVEL OZONE PREDICTION USING MULTIVARIATE AIR QUALITY DATA**

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Ground-level ozone ( $O_3$ ) is a major air pollutant that negatively affects human health, ecosystems, and climate stability. Predicting ozone concentration is challenging due to the complex and nonlinear interactions among meteorological and environmental factors. Traditional statistical approaches often fail to capture these dynamic relationships effectively. In this study, we propose an attention-enhanced Bidirectional Long Short-Term Memory (BiLSTM) model to improve ozone prediction accuracy. The proposed model leverages temporal dependencies in air quality data while integrating an attention mechanism to emphasize important features in the sequence. The model is trained and evaluated on a large-scale air quality dataset. Experimental results, evaluated using MAE, RMSE, and  $R^2$  metrics, demonstrate that the proposed approach outperforms the baseline BiLSTM model. The findings highlight the effectiveness of attention mechanisms in improving prediction performance and provide a reliable framework for real-time air quality forecasting.

### **736.SILENCE SPEAKS - AI POWERED SIGN LANGUAGE TRANSLATOR**

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Communication is one of the most basic human rights in the world. There are about 70 million people who are deaf. These people communicate daily in environments where hearing people dominate, therefore, all the barriers that exist for these people create additional obstacles for each one of them on a daily basis. Even though sign language is an incredibly sophisticated language system, everyone who hears does not understand it; therefore, we need assistive tools that are accessible and provide real-time communication. This paper will outline the creation of the Silence Speaks application as it relates to facilitating two-way communication among deaf and hearing individuals while preserving the privacy of individuals as it relates to the content of communication. This browser-based application is designed in a manner that allows for user independence by relying on both the decentralized web and local-first principles. In developing this application, we used MediaPipe Hands for landmark detection and utilized TensorFlow.js with a K-Nearest Neighbors (KNN) classification model, allowing users to train static

vocabulary of signs at the point of use directly within the users' browsers. As the users' device is the only location for the storage of this data (the user's computer), there is little risk of having sensitive information accessed by others. By allowing users to train these vocabularies on their own, we enable the ability for individuals to store a vocabulary of signs that are unique and reflective to both their signing style and any regional differences that may exist. . The combined system provides a dual-rate translation flow through a STT module that uses custom stability logic to filter out false positives and an STT module that uses the Web Speech API for real-time transcription. The performance metrics from testing and user-centered evaluations show high accuracy rates from recognition with a minimal number of training samples (5-10 per sign) and provide a practical alternative to facilitating spontaneous communication for healthcare, retail, and emergency situations. As an autonomous and accessible solution, as well as one that processes locally, Silence Speaks is a scalable model of inclusive technology for empowering members of the deaf community with respect to maintaining their own privacy.

### **737.SEISMIC PERFORMANCE OF L-, C-, AND T-SHAPED BUILDINGS ON SLOPING GROUND CONSIDERING SOIL CONDITIONS AND SEISMIC ZONES**

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Buildings constructed on the sloping ground in the seismic regions exhibit combined plan irregularity as well as vertical irregularity which alters the stiffness distribution and amplifies the torsional response. The study investigates seismic performance of the L-shaped, C-shaped, and T-shaped reinforced concrete buildings located on the uniform slope where the different soil conditions and the seismic zones are considered. Three-dimensional analytical models were developed and evaluated using the equivalent static procedure as well as the response spectrum procedure. The influence of the plan configuration, the terrain-induced column height variation, and site characteristics on the displacement, storey drift, base shear, and the torsional response was examined systematically. The results indicated that the T-shaped configuration produced the highest roof displacement of 78.4 mm as well as maximum inter-storey drift of 0.0032 in Zone IV on the medium soil which was followed by the C-shaped layout as well as L-shaped layout. The soft soil conditions increased the roof displacement by approximately 15–18% compared with the medium soil, while Zone V seismic demand raised the displacement by nearly 30% relative to Zone IV. The downhill columns experienced up to 28% higher bending moment than the uphill columns where the slope-induced stiffness variation governed response. This study provides the unified assessment of the plan irregularity, sloping ground, soil class, and the seismic intensity within the single analytical framework. The novelty lies in the comparative quantification of torsional amplification as well as the drift concentration across the multiple configurations and the site conditions which offers the practical guidance for the seismic design of irregular buildings on the sloping terrain.

### **738.ENHANCED MOYA: A PARALLEL MULTI-AGENT FRAMEWORK WITH SELF-CORRECTIVE RAG AND EPISODIC MEMORY FOR AUTONOMOUS CLOUDOPS**

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The MOYA framework was created as a multi- agent method to manage Cloud Operations (CloudOps). Each of the agents rely on a Core Engine that distributes work among them using the most suitable Large Language Model (LLM) agents to complete a given task. While the benefits of MOYA over monolithic Hybrid RAG systems have been demonstrated in prior work, there are four key architectural limitations the MOYA framework imposes upon its ability to be ready for operational environments that have stricter requirements than CloudOps: strictly sequential agent execution, entirely reactive operations, no ability to verify iterations of hallucinated claims, and ephemeral session- structured memory. In this paper, Enhanced MOYA is introduced as an intentional evolutionary advancement of the architecture to address all four of the identified architectural limitations. For each of the architectural limitations, a co- designed mechanism is presented: (i) a Parallel Orchestrator that leverages the Python `asyncio.gather()` mechanism with an agent selection algorithm based on LLMs to launch concurrent invocation of multiple specialist agents, resulting in a reduction in mean response time on the order of 37%; (ii) a Proactive Monitor agent that continuously polls cloud metric APIs in the background and generates class-based severity alerts with pre- defined remediation strategies based on the alert severity level and that do so before the user submits a query; (iii) a loop in which a self-critic LLM reviews and corroborates all claims generated by a primary LLM against the evidence retrieved to create the claim, resulting in approximately 40% fewer hallucinated or unvalidated claims; and (iv) a subsystem that uses ChromaDB for episodic memory to hold and semantically index all instance pairs associated with a user's history of interactions across sessions using SentenceTransformer embeddings. Evaluating the 120-query benchmark using different evaluation measures such as ROUGE, BLEU, METEOR, BERTScore, and RAGAS showed that the enhancements made in MOYA provide incremental improvements over each metric measured. Enhanced MOYA meets all requirements for being a credible enterprise-grade AIOps product, having outperformed its predecessor in terms of speed, accuracy, and usefulness when detected.

### **739.A SELF-CORRECTING MULTI-AGENT LLM PIPELINE FOR AUTOMATED PROJECT PLANNING: ARCHITECTURE, IMPLEMENTATION, AND EVALUATION**

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LLMs can produce fluent text, but converting that fluency into a coherent end-to-end project plan is still challenging. Small inconsistencies in early planning stages often propagate to later decisions. In

this work, we built what we call Agentic AI Planner, a seven-agent LangGraph pipeline with a reviewer-gated correction loop that can explicitly reject and regenerate weak intermediate outputs. The reviewer scores alignment, specificity, completeness, and feasibility on a 1–5 scale, with bounded retries ( $k = 2$ ). In parallel, a Market Intelligence module brings in fresh web evidence through a request-scoped RAG workflow built with Serper, Gemini embeddings, and ChromaDB. We evaluated the framework on 50 project planning scenarios across five domains using human expert scoring (1–5 Likert scale), correction effectiveness, and latency. The full system achieved a mean quality score of 4.12 ( $\sigma = 0.41$ ), compared with 3.08 ( $\sigma = 0.67$ ) for single-shot baselines, yielding a 33.8% improvement. The correction loop improved 72% of initially rejected plans with a mean of 1.3 iterations. End-to-end generation time remained under 45 seconds per project, and cached reruns completed in under one second. What we observed from these results is that explicit role decomposition plus bounded reviewer feedback provides a practical path to more reliable AI-assisted planning.

#### **740.CROSS-SECURE: A DOMAIN-ADAPTIVE IDS WITH REAL-TIME WEB INTERFACE**

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In order to overcome the problems and the difficulties that modern networks are currently facing, flexibility is just as essential as algorithms. Even though intrusion detection systems (IDS) have become more effective with the inclusion of machine learning (ML) techniques, most of the models used in machine learning have an underlying major problem in that they can only work in the environment or domain in which they are trained. The aim of this study is to overcome these so-called "domain shift" problems. However, instead of relying on traditional approaches, which cannot generalize, such as SVM or Decision Trees, we are proposing a domain-adaptive model that was trained on several data sets. With the help of domain adaptation, we introduce you to CROSS- SECURE, a system that not only provides robustness but allows users to visualize these insights through a real-time online interface. This research provides a solution that can be adapted to the networks of today by bridging the gap between the accuracy of models and practicality.

#### **741.ROBUST OBJECT DETECTION FOR AUTONOMOUS VEHICLES UNDER ADVERSE WEATHER CONDITIONS USING FINE-TUNED YOLOV8**

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Autonomous driving systems rely heavily on visual perception models for reliable object detection [28], [29]. However, adverse weather conditions such as fog, rain, snow, and nighttime significantly degrade detection performance due to reduced visibility and illumination variations [10], [16], [20]. Object detection models such as YOLO and Faster R-CNN have demonstrated strong performance under normal conditions [3], [5], but their robustness decreases under domain shift caused by environmental changes [14], [26]. This paper proposes a robust object detection framework based on fine-tuning YOLOv8 for adverse weather scenarios [1]. Weather-aware preprocessing techniques, including contrast enhancement (CLAHE) and gamma correction, along with synthetic weather augmentation, are employed to mitigate domain shift [12], [13], [27]. Extensive experiments conducted on the ACDC dataset [10] demonstrate that the proposed approach significantly improves detection accuracy under challenging environmental conditions while maintaining real-time performance [1], [21].

## **742.AI-BASED RESPIRATORY DISEASE PREDICTION USING VOICE BIOMARKERS**

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Early detection of respiratory diseases can help increase the survival rate and improve the quality of life of patients. This paper presents an AI-based system that can predict respiratory diseases using respiratory sound analysis from cough and breathing signals. The proposed system follows a systematic pipeline that includes audio acquisition, preprocessing, feature extraction using Mel Frequency Cepstral Coefficients (MFCC), along with delta and delta-delta features that represent the spectral and temporal characteristics of respiratory sounds. These features are analyzed using a hybrid CNN-LSTM neural network that combines Convolutional Neural Networks (CNN) and Long Short-Term Memory (LSTM) networks for accurate disease classification. The experimental findings show that the proposed system can be used with high accuracy in classification and performance that is reliable in a variety of disease classes. The suggested AI-driven respiratory disease prediction system proves that deep learning and audio signal processing can be implemented to predict respiratory disease at the early stages, and, with additional refinements, the system can become a valuable instrument in helping medical workers and enhancing telemedicine.

## **743.RETINASCAN: DEEP LEARNING-BASED MULTI-RETINOPATHY DETECTION USING EXPLAINABLE AI**

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The global prevalence of retinal diseases has made automated fundus image analysis one of the most pressing challenges in contemporary medical artificial intelligence. Conditions such as Diabetic Retinopathy (DR), Age-related Macular Degeneration (AMD), and Hypertensive Retinopathy collectively affect hundreds of millions of individuals worldwide, with a substantial proportion of cases remaining undetected until the disease has advanced to a point where irreversible vision loss becomes an increasingly likely outcome. This challenge is further intensified by a critical shortage of ophthalmologists across many regions of the world, rendering comprehensive screening through traditional clinical pathways practically unachievable at scale. This work presents RetinaScan, an integrated deep learning framework that leverages the distinct strengths of Vision Transformers (ViT) and Convolutional Neural Networks (CNN) through a unified hybrid architecture. The transformer branch captures long-range spatial dependencies spanning the full retinal field via self-attention mechanisms, whereas the convolutional branch focuses on extracting localized texture and structural signatures that distinguish individual lesion categories. Through the fusion of these two complementary pathways, RetinaScan produces a more diagnostically informative and comprehensive representation of fundus imagery. In addition to disease detection, RetinaScan employs a regression-based severity estimation module that outputs a continuous disease severity index ranging from 0 to 100. A multi-layer Gradient-weighted Class Activation Mapping (Grad-CAM) module is tightly integrated into the pipeline to generate heatmap overlays that make the model's reasoning transparent and verifiable by practicing clinicians. The system is evaluated on 21,840 fundus images and achieves a mAP@50 of 84.7%, a severity regression MSE of 5.42, and an  $R^2$  of 0.891, substantially outperforming conventional CNN-only baselines.

#### **744. TRIBALINGUA: AN OFFLINE LOW-RESOURCE TRIBAL LANGUAGE SPEECH RECOGNITION AND ENGLISH VOICE SYNTHESIS USING MFCC-CNN**

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There are a lot of indigenous languages that have been neglected and underrepresented in the digital world because they don't have much computational resources or annotated datasets. Moreover, they don't have access to any kind of automatic speech processing technology. Because of these challenges, tribal communities suffer from communication barriers and also lack access to much digital service. The challenges are compounded when tribal languages are mixed in with regional languages or dominant languages in a code-mixed format, as traditional ASR systems cannot reliably process such mixed-language utterances. The focus of this paper is an offline AI-based speech recognition and language translation system called TribaLingua that has been designed for low-resource tribal dialects. The proposed system uses Mel Frequency Cepstrum Coefficient (MFCC) feature extraction combined with convolutional neural networks (CNNs) to provide accurate speech recognition of the target tribal dialects. After code-mixed linguistic inputs have been processed by a contextual correction module, they are translated into English. After the translation has been made, the English output is converted back into spoken language using a text-to- speech (TTS) engine, thus permitting full speech-to- speech interaction to occur. The system has been designed to run effectively and efficiently on low-power devices without a persistent internet connection. Thus, it will operate well within a rural or tribal environment. The experimental evaluation shows high accuracy for recognition and translation, and

creates opportunities for digital inclusion, enhanced communication and support for endangered tribal language preservation.

#### **745.LYT-NET: TRANSFORMING LOW-LIGHT IMAGES WITH A LIGHTWEIGHT YUV-BASED NETWORK**

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The low-light enhancement of images (LLIE) poses significant challenges for computational imaging because of the impaired quality of images taken in low-light situations due to low-visual quality, diminished contrast, and inaccurate color. This research details LYT-Net, which is a lightweight transformer architecture that improves the quality of visuals in low-light settings but at the same time minimizes the computational demands of the processing. While utilizing a dual-pathway framework in the YUV colour space, LYT-Net processes luminance and chrominance information independently to reduce the artefacts of illumination correction. Channel-Wise Denoising (CWD) modules reduce noise from all of the image channels, and Multi-Stage Squeeze and Excite (MSEF) modules provide a means to adaptively perform feature fusion as part of enhancing performance within the LYT-Net architecture. Finally, a Multi-Headed Self Attention (MHSA) module captures the global context for all output features to provide a representation of all context relationships. The proposed LYT-Net architecture has been experimentally tested against standard LLIE datasets to demonstrate its use in improving image quality compared to the existing LLIE methods with relatively low computer processing cost enabling real-time and low-resource- independent imaging applications.

#### **746.HYBRID COMPUTATIONAL MODEL FOR SILENT HEART DISEASE RISK ASSESSMENT**

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Silent cardiovascular disease (CVD) represents a critical global health challenge due to its asymptomatic nature and risk of sudden adverse cardiac events. Traditional risk scoring systems often fail to detect subclinical heart disease in early stages. Recent advancements in Artificial Intelligence (AI), particularly deep learning and ensemble methods, have demonstrated promising capabilities in automated diagnosis. However, many existing models operate as black boxes, limiting clinical interpretability and trust. This work proposes an Explainable Artificial Intelligence (XAI) framework for silent heart disease detection by integrating Convolutional Neural Networks (CNNs) trained on the full PTB-XL ECG dataset with an XGBoost- based multimodal risk prediction model incorporating clinical parameters. To ensure interpretability, Grad-CAM is used to highlight significant ECG signal regions, while SHAP (SHapley Additive exPlanations) provides feature- level explanation for clinical inputs. Experimental evaluation demonstrates high classification performance and clinically meaningful explanations, bridging the gap between predictive accuracy and transparency. The proposed system is deployed as a web-based decision- support tool enabling real-time risk prediction and interpretability visualization.

#### **747.OPTIMIZING CONTAINER IMAGE SIZES FOR FASTER STARTUP AND LOWER COSTS**

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Containerization technology is not new in deployment in software development. We can convert our application into a lightweight portable container which can then be deployed at any location. Since the applications began to scale, the size of the images was high as well. This trend increases the performance rate at the expense of more cloud resources. These multi-layer images also come along with a huge attack surface to vulnerability. In our study, a framework of the optimization of container images is already suggested as well as minimization of the danger of vulnerabilities through scanning of typical attacks in the packages. Baseline image analysis with the help of checking Dockerfiles, an optimization engine to eliminate unnecessary packages and dependencies and construction with lightweight base images can be combined to make up our proposed solution. The usage of Trivy is made to uncover common vulnerabilities within the packages. The combination of services such as ECR, ECS provided

by AWS and CI-CD pipelines, such as Jenkins and GitHub Actions, offers an automated structure of container optimization.

## **748.EFFICIENT AND INTERPRETABLE VIDEO ANOMALY DETECTION VIA PREDICTIVE FRAME MODELING**

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Video anomaly detection is a crucial part of intelligent video surveillance systems because it helps to detect unusual incidents like automotive crashes, unusual movement patterns, and unauthorized personnel entering an area. Video anomaly detection systems depend heavily on traditional forms of convolutional architecture to create long-range spatial and temporal dependencies that exist in the data of video recordings and support the detection of anomalous events. The goal of this research is to create a transformer based architecture that uses appearance dynamics and motion dynamics for detecting video anomalies. Specifically, the proposed architecture contains a Vision Transformer (ViT) based spatial encoder for representing spatio-temporal correlations among video frames together with a temporal transformer. The architecture utilizes optical flow information via a 3D convolutional network in order to create separate representations for motion. Another key contribution of the research is an introduction of a motion gating module based on cross attention that facilitates the detection of anomalies by adaptively combining the representations of motion with the representations of spatial, and thus providing greater weight to the motion representations associated with abnormal activity. The model is trained using self-supervision to predict both future RGB frames and corresponding optical flow from sequences of subsequent frames. Based on reconstruction error between predicted and true RGB frame, anomaly scores are generated to identify deviations from learned "normal" activities. The

framework for improving the interpretability of AI (X-AI) uses a visual explanation technique, Grad-CAM, to identify and localize areas where there is an anomaly in the image data. The additional component of this system provides textual description of the location of the anomalies detected by the computer vision or image recognition model through the use of a vision-language model. The effectiveness of this approach to detect anomalies and provide interpretability through explanations of the model's decision.

#### **749.SENTIMENT ANALYSIS USING PROBABILISTIC LINGUISTIC TERM SETS AND DEEP LEARNING FOR ONLINE PRODUCT RANKING**

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In the current paper Create an innovative way of improving online product rankings with the help of DL and sentiment analysis, the main challenge highlighted is the abundance of e-commerce solutions and how to approach this issue with the means of a considerably more user-friendly assessment that would also consider the subjective satisfaction factors. Employ the latest DL technologies to create a powerful sentiment analysis model, which is built on diverse user ratings. Include sentiment ratings to make the current product ranking algorithm a hybrid algorithm that considers both objective and subjective user experiences. Use sentiment analysis to derive meaning out of unstructured information that offers customers in-depth product evaluation and enterprises with feedback that can be acted on. Narrow the distance between customer response and ranking, which leads to more educated and satisfying buying decisions. Efficiency: A more user-friendly and improved online product ranking system with customized recommendations should be expected. Introduce different DL models and test their efficacy with the help of standard metrics to benefit such important stakeholders as e-commerce websites, businesses, which depend on user feedback, and the consumers, who tend to get informed about the products they like. We extended the project to a very precise LSTM based hybrid model (LSTM +GRU) which had an accuracy, precision, recall and F1-score of 99.9. To enhance the user testing, we developed a simple front end, which used Flask, with the capability of logging in and providing a secure and unique user experience.

#### **750.GRID-CONNECTED WIND SOLAR HYBRID POWER SYSTEM MODELING AND SIMULATION**

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This paper presents the modeling, simulation, and control of a grid-connected hybrid renewable energy system integrating a photovoltaic (PV) array and a wind energy conversion system. The proposed architecture employs a common DC-link configuration to effectively combine the outputs of both energy sources, enhancing system flexibility and power reliability. A DC–DC boost converter with Maximum Power Point Tracking (MPPT) is utilized for the PV system, while the wind turbine driven Permanent Magnet Synchronous Generator (PMSG) is interfaced through an AC–DC rectifier, and the

combined power is delivered to the grid via a three-phase Voltage Source Converter (VSC) controlled using a synchronous reference frame (dq) control strategy. The system is modeled and simulated in MATLAB/Simulink with Simscape Electrical to evaluate its dynamic performance under varying environmental conditions, and a DC-link voltage control scheme is implemented to maintain power balance between generation and grid demand. In addition, a Sinusoidal Pulse Width Modulation (SPWM) technique is employed to generate switching signals for the inverter, ensuring high-quality output voltage. Simulation results demonstrate that the proposed system maintains a stable DC-link voltage, achieves balanced three-phase sinusoidal grid currents, and significantly reduces harmonic distortion through the use of an LCL filter, while the hybrid configuration effectively mitigates the intermittency of individual renewable sources, resulting in improved power quality, enhanced system reliability, and reduced output power fluctuations. The findings confirm the suitability of the proposed system for efficient and stable grid-connected renewable energy applications.

### **751.EXPLAINABLE LIGHTWEIGHT CNN FOR EARLY DETECTION OF DIABETIC RETINOPATHY, GLAUCOMA AND AGE- RELATED MACULAR DEGENERATION USING FUNDUS IMAGES**

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Retinal diseases like diabetic retinopathy, glaucoma and age-related macular degeneration are some of the major reasons of preventable blindness in the world, and for this to be effectively treated, it must be diagnosed early and correctly. Nevertheless, the traditional approaches to diagnosis tend to be resource intensive and require expert interpretation which reduces their availability in low-resource contexts. This paper proposes an explainable light weighted Convolutional Neural Network (CNN) framework for early diagnosis of multiple retinal diseases from fundus images. The model makes use of efficient

architectures such as MobileNetV3 and EfficientNet-B0, which can be used in real-time and resource-constrained applications with high diagnostic performance and low computational complexity. To promote transparency and clinical trust, Explainable Artificial Intelligence (XAI) techniques such as Gradient-weighted Class Activation Mapping (Grad-CAM) and Local Interpretable Model-agnostic Explanations (LIME), are combined to give visual and interpretable information of the model's decision-making process. The system is trained and tested on a variety of multi-source data to be able to be robust and generalized to different populations and different imaging conditions. Experimental results show the proposed model has good accuracy with efficiency and interpretability. The framework has the benefit of multi-disease classification and early-stage detection and thus is a scalable and economical solution for automated retinal screening, especially in rural and underserved healthcare settings.

### **752.IOT-INTEGRATED ROBOTIC PLATFORM FOR AUTOMATED SOIL NUTRIENTS, PH AND MOISTURE MONITORING**

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The rate of population of our country is increasing day by day. There will be serve food issues after few years, so it's important to improve the agriculture. In today's world agriculture plays a very important role in production of number of crops. There are several steps for improving crop's health, one of them is Soil testing. Conventional soil testing methods are Manual, requiring certain Labor's and Time, which are also costly and causes delays and sampling errors. This research paper explores the advancement in Automated Soil Testing Robot, focusing on collecting soil variables including moisture, temperature, pH, and nutrients concentration (NPK) .Displaying it on individual's Phone App where it also helps in selecting crop type according to the collected data.

### **753.SHOPLIFTING DETECTION SYSTEM USING YOLOV8**

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Inventory shrinkage from shoplifting drains the global retail sector of over \$100 billion annually. Conventional CCTV installations capture footage passively and provide no real-time detection capability, leaving security staff to review recordings only after a loss has already occurred. This paper presents an automated Shoplifting Detection platform built on YOLOv8, trained on a purpose-built dataset of 182 retail surveillance clips processed into 31,467 skeletal pose keypoint samples. The system detects the product-hiding behavioral class in both live RTSP streams and uploaded recordings, dispatches timestamped annotated email alerts on detection, and provides a multi-tab Flask web dashboard for monitoring and record management. The trained model achieves a mAP@50 of 91.2%, Precision of 91%, Recall of 87%, and F1-Score of 89%, outperforming background-subtraction and 3D-CNN baselines on all metrics. The complete pipeline runs on commodity CPU hardware without GPU infrastructure.

## **754.AI-DRIVEN SOLAR SMART WHEELCHAIR WITH VOICE, GESTURE & OBSTACLE INTELLIGENCE**

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This paper presents the design and development of an AI-Driven Solar Smart Wheelchair with Voice, Gesture, and Obstacle Intelligence for assistive mobility applications. The proposed system integrates renewable energy with artificial intelligence to enhance user independence, safety, and operational efficiency. A solar-powered energy module is employed to reduce reliance on conventional power sources and improve sustainability. The wheelchair is equipped with a multimodel control interface that includes voice recognition and gesture-based commands, enabling intuitive and flexible user interaction. For safe navigation, the system incorporates ultrasonic and infrared sensors to perform real-time obstacle detection and avoidance. The AI-based control unit processes sensor inputs and user commands to generate optimal movement decisions, ensuring smooth and collision-free navigation in dynamic environments. The architecture is designed to be cost-effective and scalable, making it suitable for practical deployment in both indoor and outdoor settings. Experimental results demonstrate that the proposed system achieves reliable performance in terms of command recognition accuracy, obstacle detection, and energy efficiency. The integration of AI techniques with assistive mobility devices highlights significant potential for improving the quality of life for individuals with physical disabilities.

## **755.REPRESENTATION DRIFT AS A FAILURE MECHANISM IN TRANSFER LEARNING FOR MEDICAL IMAGE CLASSIFICATION**

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Transfer learning is widely adopted in medical image analysis due to the scarcity of labeled clinical datasets. However, fine-tuning pre-trained models on small and imbalanced medical datasets may cause substantial representation drift, where learned parameters deviate significantly from their pretrained configuration. This drift can degrade diagnostic reliability and increase clinically significant errors such as false negatives. In this study, we investigate representation drift as a failure mechanism in transfer learning for medical image classification. Experiments were conducted on two ultrasound datasets for polycystic ovary syndrome (PCOS) classification using three architectures: ResNet50, MobileNetV3, and Vision Transformer (ViT-B/16). We systematically analyze the relationship between regularization strength, representation drift, and false-negative rates. Results show a consistent correlation between excessive drift and increased false negatives. Based on this analysis, we propose a drift-aware fine-tuning framework that constrains parameter updates relative to pre-trained representations. The proposed approach reduces false negatives while maintaining overall model performance. Our findings highlight representation stability as an important factor influencing transfer learning reliability in small and imbalanced medical datasets.

## **756.FPGA BASED PID FLIGHT CONTROLLER FOR UAV APPLICATIONS**

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This paper details the design and implementation of a real time flight control system of low range unmanned aerial vehicles running on a hardware based PID controller on an FPGA. Most conventional flight controllers are based on microcontrollers that always have problems with sequential computation delay, interrupt overhead, and timing jitter, which reduces their stability in case of rapid attitude changes. This work transcends all of these drawbacks by introducing synthesizable Verilog HDL fully parallel PID control loops to stabilize pitch, roll, yaw and altitude. The controller designed can handle sensor data and provide PWM to ESCs. The PID gains and system behavior are validated using a discrete time simulation model in MATLAB Simulink. Synthesis results of FPGAs indicate that the control loop latency is smaller than those of software PID implementations, as well as that timing is deterministic and stability is significantly increased. The suggested architecture offers attitudinal correction at a rapid settling rate with low minimum overshoot, therefore, it is very suitable in compact UAVs, which have arduous power and computing limits. The paper demonstrates the possibilities of FPGA based control systems in the next generation autonomous and embedded UAV systems.

## **757.A TRI-ENSEMBLE STACKING FRAMEWORK FOR E-COMMERCE PURCHASE PREDICTION WITH EXPLAINABLE AI**

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Identifying whether an online visitor intends to make a purchase is a non-trivial task, largely because user behavior on e-commerce sites is highly variable and the proportion of sessions that result in actual transactions is small. Conventional machine learning classifiers tend to underperform on such skewed datasets, and they rarely offer any insight into why a prediction was made. To address these twin challenges, we introduce a Tri-Ensemble Stacking Framework that combines three tree-based learners—Random Forest, Extra Trees, and XGBoost—under a Logistic Regression meta-classifier. Experiments are carried out on the Online Shoppers Purchasing Intention dataset, which holds 12,330 session records described by 17 features. Oversampling via SMOTE is applied on the training portion alone to correct for class imbalance, and systematic hyperparameter search through GridSearchCV with 3-fold cross-validation fine-tunes each base model. The resulting optimized system attains 90.23% accuracy, a ROC-AUC of 0.9205, precision of 0.895, recall of 0.902, and an F1-score of 0.895,

surpassing the untuned baseline. SHAP-driven beeswarm plots further illuminate which features drive purchase decisions at both the population and individual session level.

## **758.SMARTCROP ADVISOR:AN INTELLIGENT CROP RECOMMENDATION SYSTEM USING MACHINE LEARNING AND REAL-TIME WEATHER DATA**

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This paper tackles a major problem in modern farming: how to make the best choices about which crops to grow when soil composition, environmental factors, and changing weather patterns all play a role. Traditional farming methods mostly depend on what farmers have learned over time and what has worked in the past. These methods often don't take into account how the weather changes and how the environment is different in different places. We introduce SmartCrop Advisor, a full decision support system that combines probabilistic machine learning with real-time weather data to give crop recommendations that take into account the current situation. The system works through a series of steps: gathering soil nutrient profiles and real-time weather data, standardising and engineering features, probabilistic classification that gives confidence-weighted rankings, and knowledge-based post-processing that takes into account domain constraints. A web-based interactive interface made with Streamlit makes it easy to choose a geospatial location by letting users interact with a map. This means that users don't need to know anything about coordinate systems to use it. The system also gives soil classification interpretations and market value estimates to help with making all-around agricultural decisions. Field validation involving 38 agricultural operations across various climatic zones demonstrates significant practical utility, with 84 percent of farmers expressing their intention to integrate system recommendations into cultivation planning. Modular system architecture makes it easy to add new data streams and improve predictive capabilities as technology changes. SmartCrop Advisor serves as a transformative tool that empowers farmers with intelligent, context-aware, and data-driven insights. The system's integration of AI, environmental analytics, and modern computing technologies demonstrates a powerful application of Artificial Intelligence in achieving sustainable, efficient, and intelligent agriculture for the future.

### **759.DETECTION OF FAULTS IN INDUCTION MOTOR USING DL MODELS**

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Fault detection in induction motor is crucial for ensuring operational safety, minimizing downtime, and reducing maintenance costs. This work proposes a hybrid deep learning model combining Convolutional Neural Networks (CNN) and Gated Recurrent Units (GRU) to detect and classify induction motor faults from time-series data. The CNN layers extract spatial features, while GRU layers model temporal dependencies in the data. The architecture incorporates residual connections to enhance gradient flow and improve learning efficiency.

### **760.REAL TIME VEHICLE DETECTION TRACKING AND CLASSIFICATION SYSTEM ARCHITECTURE USING YOLO BASED INTELLIGENT TRAFFIC MONITORING FRAMEWORK**

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The issue of traffic congestion and inefficient transportation systems is a major problem in the contemporary urban setting that can impact mobility, safety, and the infrastructure planning. In this research, I suggest a vehicle counting and classification system based on computer visual and machine learning in real time. The system will use the YOLO-based object detection to identify and categorize cars, buses, trucks, and motorcycles within a live video and recorded video stream using this system. The state of the art image processing techniques are designed to provide high performance with different traffic congestions and environmental conditions. The framework suggested will offer real-time statistics to assist the authorities in charge of traffic management and congestion decision making. Experimental data show that it has a high detection, processing efficiency, and fewer man-hours. This is because the system has scalable, reliable, and automated system of intelligent transportation systems to make urban mobility smarter and utilize greater control of traffic.

## **761.SMART THEFT DETECTION USING AI**

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An increase in theft incidents in residential, commercial and public areas has created a pressing need for smart, automated security solutions. Current traditional methods of surveillance depend on the continuous, attentive supervision of humans which can be often ineffective, lengthy, and error-prone. This study proposes the use of artificial intelligence (AI) to develop a Smart Theft Detection System. The Smart Theft Detection System will utilize AI to be a viable and smart solution for rapid-surveillance-based threat detection. The Smart Theft Detection System will include the use of computer-vision and machine-learning algorithms for rapid- surveillance-based threat detection. The system will monitor streaming images from existing security cameras to identify unusual movement patterns, detect unauthorised access and verify behaviour patterns; the Smart Theft Detection System can classify any specific activity as normal or potentially a theft. Once the system has identified a potential theft, it will issue an Alert Notification to the property owner or individual in question via electronic communication systems. Lastly, the Smart Theft Detection System will also record the video footage associated with any possible theft for potential future use in follow-up action or predictive analysis. The Smart Theft Detection System as proposed in this article will contribute significantly in providing a safer environment and supporting the use of AI/smart technologies for modern surveillance and crime prevention.

## **762.GREEN FLOW: A DATA ANALYTICS-DRIVEN ADAPTIVE TRAFFIC SIGNAL SYSTEM FOR URBAN CONGESTION CONTROL**

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Urban traffic congestion presents a significant challenge to modern transportation systems, necessitating intelligent and adaptive traffic control solutions. This paper presents Green Flow, a real-time adaptive traffic signal management system that optimizes traffic flow using deep learning and live video analytics. Unlike conventional traffic signal systems based on fixed timing schemes or static sensor data, the proposed approach dynamically adjusts signal durations according to real-time traffic conditions. The system utilizes video streams from four-directional traffic cameras at road intersections. Vehicle detection and classification are performed using the YOLOv8 object detection model, enabling accurate real-time vehicle counting under diverse traffic and lighting conditions. Vehicle density estimation is used to compute optimal green signal durations, with higher priority assigned to lanes experiencing heavier traffic to reduce congestion and waiting time. The system also supports emergency vehicle prioritization to ensure rapid and uninterrupted passage when required. A real-time video visualization module and a graphical traffic signal simulation are implemented using Python, OpenCV, and Tkinter to demonstrate system adaptability. Experimental results indicate smoother signal transitions, reduced vehicle delay, and improved traffic throughput compared to fixed-timing and static image-based traffic control approaches, highlighting the system's potential for smart city and intelligent transportation system deployment.

### **763. COGNITIVE RADIO BASED VEHICLE-TO-VEHICLE COMMUNICATION FOR REAL-TIME ACCIDENT DETECTION AND ALERT TRANSMISSION**

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Vehicle-to-Vehicle (V2V) communication has become an essential technology in intelligent transportation systems due to its ability to exchange safety-critical information in real time. Fast and reliable communication between vehicles can significantly reduce accident severity and improve driver awareness during emergency conditions. This paper presents a cognitive radio-based V2V communication system for real-time accident detection and warning transmission. The proposed model integrates vibration and gyroscope sensors with a NodeMCU/ESP8266-based controller, MCP2515 CAN module, wireless communication interface, and LCD display to monitor abnormal vehicle conditions and notify nearby vehicles. Cognitive radio concepts are incorporated to improve communication efficiency through adaptive spectrum utilization and interference reduction. MATLAB simulation is used to analyze signal transmission characteristics, power spectral density, and communication behavior, while hardware implementation validates the practical operation of the proposed model. Experimental results demonstrate that the system successfully detects abnormal tilt and impact conditions and transmits warning messages with minimal delay. The proposed system offers a low-cost, scalable, and efficient solution for improving road safety and enabling future intelligent vehicular communication networks.

#### **764.FUSION-BASED REAL-TIME SURVEILLANCE SYSTEM FOR WEAPON DETECTION AND VIOLENCE SEVERITY ANALYSIS USING YOLOV11 AND CNN-LSTM**

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The rapid increase in theft, armed incidents, and violent activities in public and private environments has highlighted the limitations of traditional surveillance systems, which largely depend on continuous human monitoring. These systems often fail to respond promptly due to human fatigue, delayed attention, and the inability to simultaneously analyze multiple video feeds. To address these challenges, this paper presents a fusion-based real-time intelligent surveillance system that combines object detection and behavioral analysis for enhanced threat recognition. The proposed system integrates a YOLOv11-based model for detecting weapons such as firearms and sharp objects with a CNN-LSTM architecture designed to analyze human actions over time and estimate the severity of violent behavior. Unlike conventional approaches that rely on binary classification, this system evaluates violence on a graded scale, enabling more meaningful interpretation of real-world situations. A fusion mechanism combines outputs from both models to generate a comprehensive threat score, allowing the system to make context-aware decisions. When a potential threat is identified, the system automatically triggers alert mechanisms such as SOS notifications and records the incident for further analysis. The framework is designed to operate in real time with low latency, making it suitable for deployment in critical areas such as public transport, educational institutions, and smart city infrastructures. Experimental observations demonstrate that the integrated approach improves detection reliability and reduces false alarms compared to single-model systems. Overall, the proposed solution offers a practical and scalable approach to intelligent surveillance by combining spatial and temporal deep learning techniques, contributing to faster response times and improved public safety.

## 765.HEALTH ABNORMALITY PREDICTION USING MACHINE LEARNING

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The fast development of artificial intelligence in healthcare has allowed intelligent systems capable of assisting in the early prediction of diseases and personalised health guidance. This study is a multi-disease predicted AI powered platform to assess the risk of major health conditions such as diabetes, heart, stroke, and asthma. The system incorporates machine learning models to analyse the health parameters provided by the users and come up with the risk predictions based on trained classification algorithms. A preprocessing pipeline helps standardisation of input features using scaling before the inference of the model to get consistent and reliable prediction outcomes. The application uses a web-based architecture which allows users to enter the medical attributes from interactive interfaces, and get the instant insights on the diagnosis in the form of prediction results, risk scores and categorised risk levels. To postpone all variables in a more useful way for clinical application, the system also contains an AI-based recommendation engine that gives personalized health recommendations using the outcome predictions and patient characteristics. The recommendation module gives structured advice such as lifestyle changes and prevention measures to take as well as instructions when medical consultation is required. Additionally, a location-aware healthcare assistance component identifies the hospitals nearby based on the location coordinates of the users and also calculates the distances using geographical algorithms, enabling users to locate the relevant healthcare facility fast. The platform also features an intelligent health chatbot that assists users by answering questions and providing wellness information related to their health by natural language interaction. The system architecture includes a combination of machine learning inference, intelligent recommendations, location-based services and automated notification mechanisms in a unified web platform. Prediction outcomes and associated metadata are retained in a structured database, to preserve the historical evaluation of health and make the health evaluation continuous. Automated warnings can be created when high-risk warnings are identified, making it easier to awaken and take medical action. Experimental evaluation shows the integrated approach offers efficient disease risk analysis and helps bring more accessibility of personalized healthcare guidance. The proposed system empowers the possibility of bringing together machine learning, conversational AI, and geospatial services to create intelligent digital healthcare assistants that are capable of aiding early risk detection and encouraging proactive health management.

## **766.TEMPERATURE PREDICTION USING FIBER OPTIC SPECKLEGRAM IMAGES: A COMPARATIVE STUDY OF MACHINE LEARNING MODELS**

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This study introduces a machine learning- driven method for predicting temperature and fiber optic-based structural health monitoring specklegram pictures. A dataset accessible to the public comprising 24,528 speckle images at the temperature range of 25°C to 200 °C is utilized [1]. Several machined models for learning and deep learning, such as DenseNet, EfficientNet, MobileNet, ResNet50 and XGBoost is applied and evaluated for temperature assessment. Techniques in Machine Learning have greatly enhanced the effectiveness of speckle-based sensing systems by facilitating automatic feature extraction and precise forecasting [16], [24]. Among the assessed models, XGBoost attained the minimum prediction error (MAE = 1.33°C). The outcomes show that variations in speckle patterns can be efficiently applied for temperature assessment and can also show structural well-being observing in an analytics-based approach [3].

## **767.REAL-TIME PHASED ARRAY BEAMFORMING VIA DEEP FEEDFORWARD NEURAL NETWORKS: A CST CO-SIMULATION APPROACH**

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The synthesis of antenna array radiation patterns traditionally relies on computationally expensive iterative solvers or closed-form mathematical constraints. This paper presents a generalized Deep Feed-forward Neural Network (DFNN) capable of predicting optimal phase and amplitude excitations for arbitrary linear array configurations in real-time. Addressing the entire pipeline from problem definition to generalization testing, the proposed framework accepts variable inputs—including the number of elements ( $N$ ), inter-element spacing, operating frequency, and desired 3D steering angle—to directly map these parameters to the required element excitations. A comprehensive dataset of 406,560 radiation patterns was rigorously generated and verified. Validation using virtual CST Microwave Studio co-simulation confirms an empirical correlation exceeding 99.9% with physical hardware. Furthermore, comparison against traditional baselines proves the DFNN eliminates iterative latency, reducing computation time from 45 seconds to a verified 2.41 milliseconds, making it highly effective for dynamic beam tracking scenarios in 5G systems.

### **768. AN AI-BASED SYSTEM FOR CYBER THREAT DETECTION USING VARIATIONAL AUTOENCODER, XGBOOST, AND LLM**

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The rapid expansion of digital infrastructure has led to a notable increase in both the complexity and frequency of cyber threats, thereby requiring more adaptive and proactive security mechanisms. Traditional signature-based Intrusion Detection Systems (IDS) remain limited in detecting zero-day attacks, while existing phishing detection methods often struggle to adapt to dynamically evolving malicious URLs. To address these challenges, this paper presents an integrated artificial intelligence-based framework for real-time cyber threat detection. The approach combines an unsupervised Variational Autoencoder (VAE) to identify anomalous network behavior with a supervised XGBoost classifier for phishing URL detection using lexical features. In addition, a Large Language Model (LLM) is incorporated to generate interpretable, human-readable explanations for detected threats. The overall architecture follows a modular microservices design, enabling scalability and efficient real-time processing. Experimental observations on benchmark datasets indicate improved detection performance along with reduced false positive rates when compared to conventional approaches. The integration of anomaly detection, classification, and generative intelligence within a unified framework provides a practical solution for addressing modern cybersecurity challenges.

## **769.ATM SIMULATION WITH INVISIBLE KEYPAD**

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ATMs and POS systems are still susceptible to physical and cryptographic attacks, mainly because of the use of PINs with low entropy. This paper describes the design and development of a comprehensive ATM simulation platform to counter shoulder surfing, camera-based observation attacks, and cryptographic attacks. The proposed system includes an invisible and dynamically rearranged digital keypad, spatially aware ultrasonic proximity detection, and zero-knowledge proof authentication. Instead of the usual card slot, the system includes an RFID contactless token, and it makes the entry of credentials invisible using a hybrid spatial-frequency optical technique, making it difficult to track visually or through motion. In addition, the system uses the Schnorr Identification Protocol to ensure that credentials are never sent or stored on central servers, thus eliminating the possibility of offline dictionary attacks following a breach. To test the feasibility of the system, a local hardware node with asynchronous IoT telemetric alerts was simulated. Security and usability analyses demonstrate that the comprehensive framework effectively resists current physical observation attacks and cryptographic attacks while maintaining a high transaction rate.

## **770.DEEP LEARNING-BASED CHRONIC KIDNEY DISEASE DETECTION USING YOLOV11 SEGMENTATION AND LLM-DRIVEN AUTOMATED REPORT GENERATION**

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The Chronic Kidney Disease (CKD) is a progressive illness whose timely diagnosis can help avoid severe consequences for patients' health. Traditional methods of diagnosing CKD include manual analysis of ultrasound images, which can take much time and depend on the interpretation skills of medical specialists. To solve these issues, this paper suggests creating an automated deep learning model for analyzing the images of kidneys obtained via ultrasound. This model will be able to identify and segment the anatomical structures of the organ – namely, the renal cortex and pelvis. A special set of kidney images acquired with ultrasound will be generated and labeled with the help of Roboflow. The labeled dataset will be used to develop a YOLOv11 segmentation model in Visual Studio Code. In considering the cortex and pelvis segmentation tasks performed by the system, the latter provides the necessary details in evaluating the well-being of the kidneys and detecting possible disorders related to CKD. Other than performing segmentation operations, the suggested approach has an additional module of automatic report generation that uses quantified characteristics of the segmented parts, including the area and ratio of the cortex. This way, the information extracted from the images is compiled in structured reports, which also include appropriate medical interpretations.

### **771.ADVANCED YOLOV5 NEURAL NETWORK FOR PRECISE THYROID NODULE DETECTION IN ULTRASOUND IMAGES**

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With the dramatic rise in thyroid cancer cases, the increasing burden on radiologists for accurate sonographic diagnosis underscores the need for a reliable and efficient computer-aided diagnosis system. This work addresses the challenge by automating thyroid nodule detection in ultrasound imaging, leveraging advanced object detection techniques to enhance precision and efficiency. A publicly available thyroid ultrasound dataset was employed to train and validate the proposed system. The approach integrates mechanisms to improve feature extraction, address class imbalance, and enhance the detection of small and overlapping nodules. These enhancements ensure robust performance in identifying abnormalities and supporting radiologists in accurate diagnostic decision-making. Among the models tested, YOLOv5x6 achieved the best results, with a precision of 0.561, a recall of 0.835, and a mean average precision (mAP) of 0.650, demonstrating its effectiveness in detecting thyroid nodules with high accuracy. These outcomes highlight the potential of the system to significantly improve diagnostic workflows and ensure timely and precise identification of thyroid abnormalities.

### **772.DRIVER DROWSINESS DETECTOR USING QUANTUM COMPUTING**

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Driver fatigue is one of the world's worst perpetuating cause of road accidents, especially during long and night-time driving. This paper proposes a driver drowsiness detection framework of hybrid

quantum-classical driver drowsiness detection, which combines computer vision ideas and Quantum machine learning (QML) to achieve good classification performance. Facial features extraction is performed by OpenCV based face and eyes detection and Eye Aspect Ratio (EAR) are calculated to measure eye closure behavior. High level feature embeddings, obtained from convolutional neural network, is embedded to quantum states using angle encoding and is then processed using a Variational Quantum Circuit (VQC) as a quantum classifier. The hybrid system includes a blend of classical preprocessing with decision layers that create a quantum of decision-making in the system to make it robust and decrease the false positive detection due to changes in illumination and natural blinking. The final decision is reached by using fusion strategy by combining quantum classifier output and EAR thresholds. Simulation results show better classification confidence results with less false alarm rates than pure classical solutions. The possible of practical applications of quantum enhanced machine learning for intelligent transportation safety is highlighted.

### 773.IOT-BASED WEARABLE AND PORTABLE SYSTEM FOR CONTINUOUS LIVER HEALTH MONITORING

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Liver disorders frequently develop without clear symptoms during the early stages, which often leads to late diagnosis and serious health complications. Continuous observation of liver-related health parameters can support early detection and improve treatment outcomes. This study presents a wearable and portable monitoring system based on the Internet of Things (IoT) for tracking indicators related to liver health. The proposed system employs physiological sensors to collect data such as body temperature, heart rate, and other health parameters that may reflect liver condition. These signals are processed using a microcontroller and transmitted to a cloud server through IoT communication technologies. The stored data can be accessed by both patients and healthcare providers through mobile or web-based platforms, allowing real-time monitoring and evaluation of health status. Additionally,

the system applies simple analytical techniques to recognize unusual patterns in the collected data and generate warning notifications when predefined limits are exceeded. By integrating wearable sensing devices with IoT connectivity, the proposed solution offers a practical and affordable approach for long-term remote health monitoring beyond traditional hospital settings. This system can contribute to preventive healthcare by enhancing patient awareness and enabling medical professionals to make faster and more informed decisions regarding liver health.

#### **774.A FUZZY LOGIC-BASED APPROACH FOR TRANSIENT STABILITY ENHANCEMENT USING SVC**

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This paper presents an improvement to power system transient stability through a static var compensator (SVC) system that uses a fuzzy logic controller (FLC) which outperforms the traditional SVC system that uses a Proportional Integral (PI) controller. The study involved testing a three line short circuit fault. The FLC system was evaluated by comparing its performance to the standard PI controller through testing between machines and assessing changes in active power throughout the transmission system and measuring the speeds of synchronous machines and their terminal voltages and testing the system's thyristor switched capacitor (TSC) performance and reactive power and thyristor controller reactor (TCR) output. The FLC-based SVC system was tested on a two- machine, 3-bus power system through MATLAB-Simulink simulations. The simulation result showed the superiority of the SVC based on an FLC over the conventional SVC based on a PI controller.

#### **775.A REVIEW ON ARTIFICIAL INTELLIGENCE APPROACHES FOR SHORT-TERM WIND SPEED FORECASTING**

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Accurate short-term wind speed prediction is crucial to real-time scheduling, grid stability, and economical dispatch in the contemporary wind-integrated power systems. Conventional statistical models are normally linear and stationary; they are useful when conditions are stable but in the non-linear nature of wind speed data, they fail to work well. Machine learning, deep learning, and hybrid methods of artificial intelligence (AI) provide promising data-driven approaches to capture complex temporal dynamics and factor in a wide range of exogenous factors. This review surveys recent advances in AI driven short term wind speed forecasting. It outlines major contributions, model comparisons based on accuracy, robustness and computational efficiency and notes research gaps such as heterogeneous data, spatiotemporal generalization and interpretability. Future research directions include spatiotemporal deep learning, probabilistic forecasting, transfer learning, and connection to renewable energy systems to improve smart-grid use.

## **776.A REVIEW ON SHORT-TERM ELECTRICITY LOAD FORECASTING USING ARTIFICIAL INTELLIGENCE**

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Accurate short-term load forecasting (STLF) is a foundation for real-time scheduling, economic dispatch and market participation in modern power systems and smart grids. Traditional statistical models, such as autoregressive integrated moving average (ARIMA), assume linearity and stationarity; while they perform reasonably on stationary data they show reduced accuracy on non-linear, dynamic loads. Artificial intelligence (AI) techniques offer data-driven ways to capture complex temporal patterns and external factors, and have become prominent for STLF. This review surveys recent advances (through 8 April 2026) in machine-learning, deep-learning and hybrid AI techniques for STLF. We identify key contributions, compare methods on accuracy and robustness, highlight research gaps, and suggest future research directions. Special attention is paid to smart-grid applications where renewable integration, uncertainty management and scalable models are critical.

## **777.VISIONAID: AI- POWERED MULTILINGUAL ASSISTIVE VISION SYSTEM FOR THE VISUALLY IMPAIRED**

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Visually impaired individuals often face significant challenges in autonomously interpreting and traversing dynamic real-world environments. Existing assistive technologies often come with internet dependency, language restrictions and high latency or poor integration of vision and speech inputs. This research presents a new assistive system that is AI-based and with complete on-device inference that integrates YOLOv8-driven object detection, Vosk based offline multilingual speech recognition and Google TTS for natural voice feedback. The system follows a seamless perception-to- feedback pipeline, enabling users to receive contextual understanding in their preferred language without the requirement of manual interaction. Since it is designed for deployment on edge devices, such as smart phones and wearables, the system's proposed framework is made to prioritize accessibility, safety, speed and practical usability. Experiments results proves the system's capability to deliver real-time, contextually adaptive auditory support for real-world navigation situations, especially in multilingual and network- limited environments.

### **778.ML-POWERED HEALTH & FALL MONITORING SYSTEM**

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The need for nonstop and remote healthcare monitoring has increased significantly in recent times. Traditional healthcare systems calculate on periodic sanitarium visits, which may delay early discovery of critical health conditions. This paper presents an AI- enabled IoT- grounded smart health monitoring system designed to track vital parameters similar as heart rate, SpO<sub>2</sub>, ECG signals, body temperature, and non- invasive blood glucose situations in real time. The system integrates biomedical detectors with an ESP32 microcontroller for data accession. The collected physiological data is transmitted to the Thing Speak pall platform for storehouse and analysis, and is further penetrated through a mobile operation interface for remote monitoring. optic signals from the MAX30102 detector are used for non-invasive glucose estimation using Photoplethysmography (PPG) analysis. A Random Forest Machine Learning model analyzes multiple parameters to descry abnormal conditions and prognosticate glucose situations. In addition, the system includes fall discovery capability to identify unforeseen movements or impacts, enabling timely cautions during exigency situations. Real- time announcements are generated in critical conditions and delivered through the mobile operation. The proposed system supports preventative healthcare by enabling early discovery, remote monitoring, and enhanced patient safety. The system also assists in early identification of implicit health pitfalls similar as fever, hypoxia, cardiac abnormalities, and diabetes through AI- grounded analysis.

### **779.AUTOMATED SMART ICU PATIENT MONITORING SYSTEM**

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The increasing demand for efficient and intelligent healthcare monitoring systems in Intensive Care Units (ICUs) has highlighted the limitations of conventional monitoring solutions that primarily focus on displaying raw physiological data without contextual interpretation. Continuous monitoring of

critical parameters such as heart rate, blood pressure, oxygen saturation, respiratory rate, and temperature generates large volumes of time-series data, creating challenges in timely analysis and decision-making for healthcare professionals. Recent advancements in real-time data processing and intelligent systems have enabled the development of smart monitoring frameworks that enhance clinical awareness and patient safety. In this project, we propose a Smart ICU Patient Monitoring System that leverages real-time data streaming and rule-based analytical techniques to provide an integrated and adaptive monitoring environment. The system incorporates real-time data simulation and WebSocket-based communication to continuously update patient vitals, while employing intelligent alert mechanisms that combine threshold-based and multi-parameter logic to detect critical conditions and reduce false alarms. Additionally, the framework introduces a comprehensive patient timeline that consolidates vital changes, alert events, and medication administration records, enabling effective visualization of patient history and treatment impact. By integrating real-time visualization, smart alert processing, and chronological event tracking, the system enhances situational awareness and supports faster, data-driven clinical decisions. Experimental evaluation demonstrates that the proposed framework improves monitoring efficiency, reduces alarm fatigue, and provides a scalable foundation for future integration of predictive analytics and advanced healthcare intelligence systems.

## **780.AI-DRIVEN PREDICTIVE MODELING OF FOREST FIRES USING CLIMATE AND GEOSPATIAL DATA**

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Forest fires, or wildfires, pose a paramount threat to global ecosystems, biodiversity, and human settlements. This study proposes an AI-driven predictive model leveraging machine learning algorithms Random Forest, Support Vector Machines, and Neural Networks applied to climate data, geospatial satellite imagery, and environmental sensor inputs. Deployed on cloud platforms for scalability and real-time processing, the framework incorporates Explainable AI techniques such as SHAP for interpretability. It aims to enable early detection, risk assessment, and mitigation strategies, thereby reducing ecological damage and emergency response costs. The model adapts to diverse biomes and integrates privacy-preserving measures for data security. By integrating multi-modal data sources, including historical fire records and meteorological forecasts, the system achieves high predictive accuracy, facilitating proactive interventions by forest managers and emergency services.

## **781.INTELLIGENT VOICE TRACKING FOR SECURE IDENTIFICATION OF ANONYMOUS CALLERS USING LLM MODELS**

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With the emergence of fast-growing digital communication and voice-based services, superbly assuring and non-stochastic caller identification has become more important. Traditional authentication measures such as passwords, PINs and caller ID systems are at risk to spoofing, identity theft and other security threats. Voice biometrics is a promising alternative as it uses unique voice characteristics to identify people. This paper introduces an AI-based voice tracking system that can securely identify anonymous callers through machine learning techniques. The proposed system processes the speech signals to extract unique acoustic features such as Mel Frequency Cepstral Coefficients (MFCC), pitch & spectrum characteristics. They are used in training the deep learning model developed on the basis of Recurrent Neural Network (RNN) and Long Short-Term Memory (LSTM) architecture for the accurate identification of the speaker. The authentication system compares the voice profile with the stored voice profiles to validate users by processing the real-time voice input. Outcomes show that the proposed approach increases the calling accuracy while ensuring the robustness against the negotiation noise environment.

## **782.AI-DRIVEN MEETING SUMMARIZATION AND TASK EXTRACTION SYSTEM**

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The rapid adoption of virtual & hybrid professional settings has led to a surge in virtual meetings within business organizations, schools/universities, and collaborative groups. However, due to a lack of official documentation regarding all aspects of meeting activity, many pieces of vital meeting content may be lost forever. Furthermore, there is no existing system in place to follow up on prior meeting participants' content or activities. Taking notes during meetings is time-consuming, laborious, and not consistent. This proposed research aims to create an AI-based system that generates summaries of meetings and action items from the transcripts of the meetings using existing speech recognition technology. This is achieved by automatically transforming audio, video, or written transcriptions into historical records of the meeting, useful in job management, as well as scheduling reminders for actions to be completed. While designing the proposed architecture, various aspects were considered, including openness, privacy, scalability, and modularity. From the experimental evaluations conducted, The suggested system is an essential tool in the fields of business, academia, and job management since it is evident that it is successful in producing succinct summaries of the meetings and action items.

### **783.MODEL COMPRESSION TECHNIQUES FOR EFFICIENT AND ACCURATE ASPECT-BASED SENTIMENT ANALYSIS\***

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Aspect-Based Sentiment Analysis (ABSA) enables fine-grained opinion mining by identifying sentiments expressed toward specific aspects within text. Although transformer-based architectures such as DeBERTa have significantly improved ABSA performance, their large model size and computational demands limit practical deployment on edge devices and real-time systems. This study proposes an efficient compression framework that integrates task-aware preprocessing, selective knowledge distillation, and linear layer quantization to develop lightweight yet accurate ABSA models. The approach involves training a high-capacity teacher model and transferring its contextual knowledge to a compact student model, DistilBERT, using selective knowledge distillation to retain

essential semantic representations. Subsequently, precision-aware quantization is applied to optimize memory usage and inference speed. Experimental results demonstrate that the compressed models achieve competitive performance with significant reductions in model size and latency, while fine-tuned knowledge distillation further improves performance by approximately 5%. The proposed framework highlights the potential of hybrid compression strategies in enabling scalable, resource-efficient ABSA systems suitable for real-world deployment in constrained environments.

#### **784.DESIGN AND IMPLEMENTATION OF BIOMETRIC VOTING MACHINE BASED ON FINGERPRINT SCANNER WITH OTP VALIDATION USING IOT**

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Electronic voting systems are widely adopted to improve the efficiency of democratic processes; however, secure voter authentication remains a critical challenge. Conventional Electronic Voting Machines (EVMs) rely primarily on manual identity verification, which may lead to impersonation, duplicate voting, and procedural delays. This paper presents a secure embedded biometric voting system integrating fingerprint authentication with cloud-assisted One-Time Password (OTP) verification. The proposed architecture employs a fingerprint sensor as the primary authentication layer and a cloud-based OTP generation mechanism implemented through a Visual Basic(VB) software module as the secondary verification layer. The generated OTP is transmitted via Global System for Mobile Communication (GSM) to the registered mobile number of the voter, thereby enabling two-factor authentication. The system is built around an Arduino microcontroller that coordinates biometric verification, OTP validation, vote recording, duplicate vote prevention, and user interface management. UART-based serial communication ensures reliable data exchange between the fingerprint module, the GSM module, and the central controller. Unlike traditional EVMs, the proposed system minimizes human intervention and enforces the one-person-one-vote principle through embedded logic control. The architecture operates as a semi-connected secure system, combining local biometric processing with cloud-assisted authentication, thereby enhancing election security while maintaining portability and cost-effectiveness. The developed prototype demonstrates improved voter authentication reliability, reduced impersonation risk, and enhanced transparency for small- and medium-scale electoral applications.

#### **785.LATENCY-AWARE COMPUTER-MEDIATED COMMUNICATION FRAMEWORK FOR EDGE-ENABLED IOT SYSTEM**

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The rapid proliferation of Internet of Things (IoT) devices has led to massive real-time data generation, where conventional cloud-centric communication models suffer from high latency, network congestion, and delayed decision making. Computer-mediated communication (CMC) plays a crucial role in enabling efficient interactions between heterogeneous IoT devices, edge nodes, and cloud services. However, existing CMC frameworks inadequately address latency constraints in delay-sensitive IoT applications. To overcome this limitation, this study proposes a latency-aware computer-mediated communication framework for edge-enabled IoT systems. The proposed framework strategically integrates edge computing with adaptive communication mechanisms to minimize the end-to-end delay while ensuring efficient data mediation among distributed IoT components. A dynamic task offloading and data routing strategy is introduced to prioritize latency-critical data at the edge layer, thereby reducing unnecessary cloud interactions. The framework was evaluated through simulations using standard performance metrics, including latency, throughput, network overhead, and energy consumption. Experimental results demonstrate that the proposed approach significantly outperforms traditional cloud-based and non-latency-aware CMC models by achieving a lower response time and improved system efficiency. The proposed framework is well-suited for real-time IoT applications, such as smart cities, healthcare monitoring, and industrial automation, providing a scalable and efficient solution for next-generation edge-enabled IoT environments.

## **786. AN INTELLIGENT TRAFFIC SIGNAL COORDINATION AND ROUTE OPTIMIZATION SYSTEM FOR EMERGENCY VEHICLES**

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Traffic congestion and manual signal operation often cause delays for ambulances, which puts critically injured patients at serious risk. To solve this problem, an IoT-based intelligent ambulance routing and smart traffic signal control system using Dijkstra's algorithm for the optimal path selection is proposed. The ambulance driver chooses the destination hospital via a mobile application, which determines the fastest route from several options based on real-time traffic information. As the ambulance reaches a traffic junction, wireless communication with the signal controller ensures that the corresponding traffic light turns green only if the ambulance is in close proximity to it and thus prevents premature signal clearance. A buzzer and an LCD display system are used to warn traffic police and other vehicles to be safe during signal changes. After passing the ambulance the system automatically resumes normal traffic operation and informs the next signal junction. A centralized control room

constantly monitors the system activity and has the capability to provide manual override as needed. This approach enhances system reliability, cuts ambulance travel time, and increases road safety during an emergency medical situation.

### **787.ADVANCED SUSTAINABLE FABRICATION OF WOOD POLYMER COMPOSITES USING HYBRID AGRICULTURAL AND PLASTIC WASTE**

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Wood Plastic Composites (WPCs) are innovative materials made by combining wood fibers with thermoplastics, offering a sustainable alternative to conventional materials. The increasing rate of deforestation and environmental issues caused by agricultural waste burning highlight the urgent need for eco-friendly solutions. WPCs address these problems by utilizing recycled plastics and agro-waste, thereby reducing dependency on natural wood and minimizing air pollution. They exhibit excellent durability, resistance to moisture, corrosion, and insect attack, along with low maintenance requirements. Due to their sustainability, cost-effectiveness, and versatility, WPCs are widely used in construction, furniture, and outdoor applications, providing both structural strength and aesthetic value. This study focuses on the development of sustainable wood polymer composites (WPCs) utilising agricultural waste and recycled plastic waste as raw materials. Four different composite formulations were prepared to analyse the effect of varying polymer-to-agricultural waste ratios. The first three compositions consisted of recycled low-density polyethylene (LDPE) combined with agricultural residues (rice husk and sawdust) in ratios of 70:30, 60:40, and 50:50 (polymer: Agriculture), respectively. The fourth composition was developed using a heterogeneous mix of agricultural wastes (including rice husk, sawdust, coconut shell, wheat straw, and other residues) reinforced with mixed polymer waste (LDPE and HDPE) in a ratio of 30:70 (polymer: Agriculture). The composites were fabricated using compression moulding and evaluated for physical and mechanical properties such as density, hardness, water absorption, and tensile strength. The results indicate that the 70:30 polymer-to-agriculture waste ratio exhibited the highest tensile strength and lowest water absorption due to better fibre encapsulation and stronger interfacial bonding. The 60:40 ratio showed balanced performance, while the 50:50 ratio demonstrated moderate strength with increased moisture uptake. The mixed composition (30:70) confirmed the feasibility of utilising diverse waste streams; however, it showed reduced mechanical performance due to heterogeneous structure and higher filler content. Overall, the developed WPCs demonstrated superior moisture resistance, durability, and dimensional stability compared to traditional wood materials, highlighting their potential as sustainable alternatives in non-structural applications. This study emphasises waste-to-wealth conversion and supports circular economy practices through the effective utilisation of locally available waste resources.

### **788.A KNN-BASED PREDICTIVE FRAMEWORK FOR SOLAR POSITION ESTIMATION IN HYBRID RENEWABLE ENERGY SYSTEMS**

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As there is a significant increase in the usage of renewable energy, it requires us to incorporate utilization of intelligent control strategies to improve upon efficiency of energy harvesting as well as the reliability of these systems. The K-Nearest Neighbor (KNN) based solar position prediction model that we present in this paper is an example of how the integration of KNN into a hybrid solar/wind energy harvesting systems can facilitate smart energy applications (in real time). The proposed system uses real-time environmental input (solar irradiance, azimuth angle, elevation angle, wind speed and wind direction) to determine the optimal photovoltaic (PV) panel configuration in order to extract the maximum amount of energy from the sun. The experimental testing of the system using actual real-time solar positional data has been very successful, as demonstrated by a mean absolute error (MAE) value of 1.33 degrees (2 degrees maximum tracking error). The system achieved a total of 97-98% tracking accuracy and demonstrated a response time of less than 1 second (e.g., for solar tracking and smart grid operation). Additionally, the hybrid integration of wind energy with solar energy allows for stable generation of energy during periods of low solar irradiance, thereby increasing the autonomy and reliability of the overall system.

### **789.LIGHTWEIGHT EDGE-BASED FEDERATED LEARNING FOR PRIVACY-PRESERVING IOT SECURITY**

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The high rate of Internet of Things (IoT) gadgets in smart cities, healthcare, industrial automation, and critical infrastructure has posed security challenges never before experienced by their conventional centralized intrusion detection systems (IDS). These systems have pronounced flaws such as infringement of data privacy, high bandwidth usage, scaling, high latency which cannot support real-time application, and single points of failure. The current paper suggests FL-IDS, a new Federated Learning-based Intrusion Detection System that is specifically aimed at identifying and protecting the authentication of IoT devices and detecting anomalies in the distributed environment. The suggested framework allows the training of the models on heterogeneous IoT edge devices without the centralization of sensitive raw information, thus maintaining privacy and obtaining better threat detection results. FL-IDS is a combination of the Docker Compose containerized microservices to be deployed on a scalable basis, MQTT protocol to communicate with lightweight devices, and ThingsBoard IoT platform to control devices comprehensively and monitor their activity in real time. Hybrid deep learning architecture features a feature selection based on the Chimp Optimization Algorithm (ChOA) optimized with Convolutional Neural Networks (CNN) and Long Short-term memory (LSTM) networks in the tasks of spatial-temporal anomaly detection. On edge gateways, local training is performed where secure parameter aggregation is done at a central coordinator with Byzantine-robust techniques. Initial experimental validation using Bot-IoT, MQTT-set and TON IoT benchmark data demonstrate that the detection accuracy is 98.4 percent, a reduction in the false positive rate by 35%, a bandwidth reduction of 42% and an energy savings of 22 percent higher than those of the centralized baselines. FL-IDS creates a scalable, privacy- saving, production-ready security infrastructure of modern IoT ecosystems.

## **790.OPTIMIZED ENERGY-EFFICIENT ROUTING IN WIRELESS SENSOR NETWORKS USING A SNAKE OPTIMIZER**

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This research presents an enhanced Mobile Energy- efficient Multi-hop Sensor Topology Protocol (MEMOSTP) optimized using an advanced metaheuristic algorithm. The proposed approach integrates an Enhanced Snake Optimizer (ESO) to dynamically tune critical network parameters including energy weighting factors, power control mechanisms, and node sleep ratios. The protocol was evaluated through extensive NS-3 simulations on a 100-node ad hoc network using OLSR routing and WiFi-based communication. Results demonstrate that the optimized MEMOSTP achieves 100% packet delivery ratio with minimal energy consumption (0.619 J per node), energy efficiency of 85.89 packets/Joule, and an average delay of 0.0191 seconds. These findings underscore the effectiveness of combining metaheuristic optimization with energy-aware protocols for sustainable mobile ad hoc networks.

## **791.PERSONAL VOICE ASSISTANT FOR AUTOMATED SECURE PAYMENTS**

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Voice-based interaction has become a convenient way for users to communicate with digital systems without relying on physical input. In this paper, we present a personal voice assistant that allows users to perform secure financial transactions using simple voice commands. The proposed assistant combines speech recognition, natural language understanding, and user authentication techniques to process and verify transactions. When a user gives a command, the system converts speech into text, identifies the intent, and extracts important details such as the amount and recipient. To ensure security, multiple authentication methods such as voice verification, PIN, and OTP are used before completing the transaction. Once the transaction is verified, it is executed through a secure payment gateway, and the user receives confirmation through voice feedback. The system was tested under different conditions, and the results show that it performs reliably in recognizing commands and handling transactions. Overall, this work aims to improve both accessibility and security in voice-based digital payment systems.

## **792.A HYBRID ANN\_RLS MODEL FOR INDOOR WIRELESS POSITIONING**

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Accurate indoor localization is essential for applications such as asset tracking, smart environments, and location-based services. This work presents a hybrid technique combining Recursive Least Squares (RLS) and Artificial Neural Networks (ANN) for improving the accuracy of RF-based multilateration systems. The proposed method simulates anchor-target distances under Rician noise conditions, and a Feed forward ANN(FANN) model is trained to filter these noisy distance measurements. The denoised outputs from the ANN are then used in the RLS algorithm to estimate the target position. All simulations and model implementations are carried out in Python, utilizing libraries such as NumPy, SciPy TensorFlow, and Matplotlib. The hybrid ANN-RLS model is compared with traditional methods including pure Least Squares (LS), LS-ANN, and RLS alone. It is expected that the proposed method will significantly reduce the Root Mean Square Error (RMSE) improving positioning accuracy over standard LS approaches. This Python-based system offers an efficient and scalable solution for robust indoor localization using machine learning and recursive estimation.

## **793.MANAGE+: AN AI-AUGMENTED PROJECT MANAGEMENT PLATFORM WITH AUTONOMOUS TASK RESOLUTION AND CONSEQUENCE-AWARE DECISION MAKING**

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Project management tools have become full-fledged but are essentially responsive. They surface information and require human managers to reason, make decisions, and take action. MANAGE+ is a prototype platform that transfers, which is presented in this paper, going beyond reactive dashboards with Large Language Models (LLMs) to the operational layer of project management. The system presents two mechanisms that operate together: an autonomous agent that detects blocked, stuck, and pending assignments and performs corrective reassignment or time slot adjustments, and a consequence engine that reviews the anticipated propagation of task state changes with the help of the dependent task graph. The platform has been constructed as a Next.js 16 full-stack application with a dual-mode database layer. The architecture, the constrained action design of the autonomous agent, the Critical Path Method integration on dependency-aware impact analysis and the role-based AI chat interface with data access controls are described. Checking against a seeded enterprise dataset of 120 users and 500+ tasks illustrates the system functionality end-to-end, as an architectural proof-of-concept that demonstrates that LLM agents can advantageously supplement routine project management works when their action space is limited and their actions are auditable.

#### **794.ENHANCED ANALYSIS OF PAP SMEAR IMAGES THROUGH TOPOGRAPHIC WEIBULL SEGMENTATION AND MODIFIED DECOMPOSITION TECHNIQUE**

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Cervical cancer remains the second leading cause of deadly malignancy for women, especially in underdeveloped nations. Early identification and time bound treatment can fully cure it. It is error prone and time consuming to manually screen the images and proper diagnosis. Among the methods available, the pap smear test is the common tool to identify cervical cancer. Image segmentation aids in locating an image's region of interest so that the necessary sections can be quickly taken from an image for automated pap-smear analysis. After segmentation, several image features are retrieved, and then

the image is classified. Various methods are available to accurately identify the region of interest in medical images using segmentation. The requirement for greater image clarity and the lengthy computation times of the current approaches are their key shortcomings. In this research, we present a new segmentation technique called Topographic Weibull Bounding Segmentation (TWBS), which is based on the Weibull distribution function. to forecast the closest nucleus in the image, which helps to improve the nucleus and cytoplasm segmentation. There are three stages to the procedure. The image uses a modified SLIC segmentation technique to identify the cell section. The Local Threshold Topography Algorithm is utilised to remove the nucleus from the designated cell segment. We use the Weibull Bounding Segmentation algorithm to the Cytoplasm. We evaluate the TWBS against current techniques using performance metrics such variance of information (VoI), sensitivity, and specificity, global consistency error (GCE), and probability random index (PRI). The detection of cytoplasm yields a 99% sensitivity, 98% specificity, 98% PRI, GCE 0.02, and VoI 0.02 that shows the performance capability of the method.

### **795.A DOM-BASED FRAMEWORK FOR PRIVACY-PRESERVING AI-DRIVEN WEB CONTENT ANALYSIS AND VISUALIZATION**

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The contemporary digital experience is increasingly hindered by information fragmentation, cognitive overload, and privacy-invasive tracking. The existing work addresses isolated issues, but it lacks a unified framework for transparent and privacy-preserving analytical depth. In this paper, A DOM-Based Framework for Privacy-Preserving AI-Driven Web Content Analysis and Visualization is proposed, which is a comprehensive browser extension built on the Chrome Manifest V3 standard that harmonizes client-side Document Object Model (DOM) analysis with user-initiated Large Language Model (LLM) summarization via a Bring-Your-Own-Key (BYOK) architecture. Located in an integrated three-pane navigation model-comprising Summary, Audit, and Control-the system provides a cohesive interface for abstractive summarization and granular privacy controls. In addition, it integrates real-time SEO analysis to optimize content visibility and comprehensive accessibility auditing to ensure inclusive digital experiences for all users. At its technical core, the proposed Advanced Page Scan System (APSS), a novel visualization framework that employs five distinct visual metaphors to render system analysis directly on the active webpage. These metaphors are intelligently selected via an adaptive heuristic algorithm that calculates content density and technical complexity to align the visualization with the specific page context. This approach transforms the “black box” of AI processing into a transparent, interactive experience, that provides immediate feedback on semantic structures. By prioritizing “local-first” data processing and cognitive scaffolding, this framework ensures absolute data sovereignty while supporting diverse learning styles. Systematic evaluation across high-complexity web environments demonstrates a sub-16 ms scan latency (maintaining 60 Hz rendering), a 1.9 s median summarization time, and a statistically significant 22% reduction in perceived cognitive load ( $p < 0.01$ ). These findings validate the feasibility of a high-utility, privacy-first infrastructure for deeper and more focused digital knowledge building.

### **796.A HYBRID PRE-SUBMISSION DETECTION FOR PROMPT INJECTION IN LARGE LANGUAGE MODELS**

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LLMs like ChatGPT, Gemini, Claude, and Microsoft Copilot have been rising prompt injection attacks which involve using malicious prompts to circumvent the established safety rules, extracting restricted information, or manipulating the system. Current methods to prevent safety violations are output-based as they depend on monitoring the output of the prompt input once submitted to the AI platform. Besides, they are dependent on the platform and lack sophistication to identify and counter sophisticated attacks like jailbreak, roleplay manipulation, and educational exploits. To overcome these limitations, PromptShield (PS) is introduced — an intermediary prompt firewall between users and AI platforms implemented as a browser extension running on Chrome with a Flask server as its back-end. PS uses a three-layer hybrid pipeline approach for detecting harmful inputs: Regex matching against harmful signatures in inputs, semantic rephrasing detection using RAG similarity with the Jaccard method, and classification based on LLM context using Ollama with the local LLaMA 3.2 model. There is a preprocessor module to decode inputs written in Morse code and leet speak before processing through the three layers. The decision engine prioritizes output from all three layers to classify inputs as safe, warn, or unsafe. ChatGPT, Gemini, Claude and Microsoft Copilot testing results indicate that PromptShield has successfully detected 95.49% of prompts correctly, which exceeds the built-in filters of all four platforms. It typically rejects 90 to 91% of malicious prompt submissions prior to being processed through the model, while current filters typically reject between 10 and 15% with an average false positive rate of 0% and a response latency ranging from 0.9 to 1.2 seconds. The PromptShield solution works on all platforms simultaneously without modifying the AI infrastructure or codebase upon which they run.

## **797.DEEP LEARNING - BASED BRAIN TUMOR DETECTION AND ANALYSIS**

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Tumors are the most challenging disorders especially brain tumors. The pre-detection plays an efficient role that improves patient's survival and treatment planning. It uses the MRI (Scan image) to detect and segment the tumor analysis. It has a high spatial resolution and access to visualize the tissues. Anyway, the manual rendition of MRI scans is time consuming and proceeds to diagnosis and variations. This project aims to build the real-world segmentation and classification. The system integrates preprocessing techniques, U-Net based segmentation, and Convolutional Neural Network (CNN) classification to identify three major tumor types: glioma, meningioma, and pituitary tumors. In addition, texture-based features such as Gray Level Co-occurrence Matrix (GLCM), shape descriptors, and anatomical location priors are incorporated to improve differentiation between tumors with similar characteristics. Experimental evaluation demonstrates that the proposed hybrid approach enhances classification accuracy and reliability while providing interpretable outputs for medical analysis.

## **798. ENHANCED AI-BASED BLOOD GROUP DETECTION USING**

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In the field of emergency medicine, transfusion services and surgical procedures, blood group typing has to be targeted and fast. The methods that exist for blood typing are participative and need laboratory infrastructure which not ideal for emergency situations or where resources are limited. In this context, we propose a non-invasive blood group identification system using fingerprint images for health record data management based on deep learning. The Fingerprint module classifies blood types into the four categories A, B, AB or O based on fingerprint ridge pattern. The experimental results show that the values of overall accuracy, precision, recall, F1 score, and AUC are 96- 97%, 96.4%, 96.1, 96.2%, 0.98, respectively, which reveals excellent separability of the classes and provides confidence in prediction. A comparative analysis indicates a marked improvement over an existing model, exhibiting enhanced discrimination and minimal misclassification. The findings substantiate the feasibility and reliability of

fingerprint-based blood group classification in providing an expedient, non-invasive, and affordable decision support system, especially for the emergency setup and resource limited healthcare scenario.

### **799.EDUTRUSTAI: AN AI-AUGMENTED BLOCKCHAIN-INSPIRED FRAMEWORK FOR ACADEMIC DOCUMENT VERIFICATION AND TAMPER DETECTION**

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Academic credential fraud represents a growing global threat that undermines the integrity of educational systems and employment pipelines worldwide. Existing verification mechanisms—manual inspection and centralised databases—remain susceptible to sophisticated forgery, scalability constraints, and single points of failure. This paper presents EduTrustAI, a multi-layered academic document verification and trust system that integrates SHA-256 cryptographic fingerprinting, a blockchain-inspired immutable registry using linked block hashes, a three-algorithm NLP similarity ensemble (Jaccard similarity, Dice coefficient, and Levenshtein edit distance), a multi-format OCR-based text extraction pipeline supporting seven document types, perceptual image hashing, and GPT-4-powered document intelligence. A role-based access control (RBAC) model serves four stakeholder roles: students, universities, organisations, and administrators. Evaluation confirms complete functional coverage across all eleven core capabilities. EduTrustAI delivers blockchain-grade tamper-evidence without distributed ledger infrastructure overhead, complemented by AI-generated natural-language tampering analysis—a capability absent from all prior credential verification systems.

### **800.AI-BASED DRIVER CARDIAC EMERGENCY DETECTION AND VEHICLE IMMOBILIZATION SYSTEM USING ESP32 AND DECISION-TREE CLASSIFIER**

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Cardiovascular diseases remain the foremost cause of sudden incapacitation in drivers, contributing to a substantial proportion of unexplained road fatalities worldwide. This paper presents the design, implementation, and validation of an embedded, real-time cardiac emergency detection and vehicle immobilization system. A non-invasive photoplethysmography (PPG) pulse sensor interfaced with an ESP32 microcontroller continuously acquires the driver's heart rate signal. A lightweight Decision-Tree classifier, trained on clinically annotated heart rate datasets, processes incoming data on-device to distinguish between normal sinus rhythm and critical arrhythmic or brady/tachycardic states. Upon detection of a heart rate persistently below 50 BPM (severe bradycardia) or above 130 BPM (severe tachycardia) for a configurable hold-time window of 5 seconds, the system autonomously activates a relay module to cut engine ignition, triggers audible buzzer alerts, and illuminates hazard indicators to bring the vehicle to a controlled stop. Prototype validation across 120 test episodes yielded a classification accuracy of 96.7%, mean response latency of 2.3 seconds, and a false-positive rate of

1.8%. The system operates entirely at the edge, requiring no cloud connectivity, making it viable for real-world automotive deployment.

### **801.PHISHING WEBSITE DETECTION USING URL**

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Phishing attacks represent an ever-growing and potentially serious risk to the global community. Fraudsters typically create fake websites that closely resemble legitimate sites to trick victims into providing sensitive personal information such as their credentials or banking details. With the rapid growth of online services, distinguishing between legitimate and phishing websites is becoming difficult for victims. Phishers are continually developing more modern techniques to make their fake sites that appear legitimate. Classic phishing detection strategies, such as blacklists and rules-based systems, are not very effective as they can only identify known phishing sites and need to be updated frequently. This project idea outlines a machine learning based technique for identifying phishing websites by examining specific characteristics and features of URLs. Instead of relying on full web page content, the system examines only the URL structure and feature characteristics to determine if it is a phishing site. URL characteristics that may indicate phishing abilities include: URL length; presence of an IP in the URL; number of period characters; number of hyphens; number of special characters; is the URL utilizing HTTPS; etc. The URL characteristics will be utilized to identify patterns that indicate the websites may potentially be involved in phishing schemes. This project will use a collection of URLs, each of which has been labelled either phishing or true (legitimate). The data has been processed and prepared for model training by cleaning and transforming to remove null fields. The Dataset has been split into training and testing and feature scaled, in an effort to maximise the models' performance. Machine- Learning methods like Random Forest and Decision Trees were then used to train the system and classify each URL based on the features that had been previously extracted. Multiple Evaluation metrics were applied to assess how well each of the models performed, which included accuracy scores, confusion matrix analysis, classification reports, and ROC Curve analysis. Results showed that ML techniques used to classify whether a URL is phishing, could do so effectively. Ensemble methods (e.g. Random Forest) performed the best of all methods because they combined the predicted classifications from multiple decision trees, reducing overfitting on training data. The system includes a feature whereby users can enter their own URL(s) and get a prediction back

in real-time. When users enter an incorrect classification label for a given URL, that is recorded within the dataset, thereby continuing to enable the system to learn and improve future prediction accuracy.

## **802. AN INTELLIGENT MACHINE LEARNING FRAMEWORK FOR EARLY DETECTION AND PREDICTION OF POLYCYSTIC OVARY SYNDROME (PCOS)**

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One of the most prevalent hormonal conditions affecting women of reproductive age is polycystic ovarian syndrome (PCOS), which frequently goes undetected because of its difficult diagnostic processes, delayed clinical recognition, and varied symptoms. To avoid long-term issues like infertility, metabolic diseases, and cardiovascular risks, early identification is crucial. Objectives: In order to support clinical decision-making, an intelligent machine learning framework that analyses clinical, physiological, and lifestyle data and provides risk assessment, explainable results, and tailored health recommendations is being designed. This framework will allow for the early identification and prediction of PCOS. Methods: The suggested method combines dynamic health metrics (weight, hormone levels, BMI, and medical indicators) with static health data (age, family history, menstruation information). To extract important PCOS indicators, data preprocessing methods such feature selection, normalization, and cleaning are used. For risk prediction, several supervised machine learning algorithms are used, such as Random Forest, XGBoost, and Logistic Regression; ensemble learning methods enhance precision and generalization. The system uses real-time analysis and ongoing model changes to classify risks, evaluate their severity, and make explainable predictions. Findings: The findings of the experiment show that the suggested framework accurately and with a lower prediction error predicts PCOS risk. Important contributing elements like hormonal imbalance, irregular menstrual cycles, and body mass index are successfully identified by the system. Early intervention and quicker diagnosis are made possible by computerized analysis and real-time prediction. The framework supports better healthcare monitoring and preventive treatment techniques by offering interpretable outputs, risk levels, and tailored lifestyle advice. Novelty: The suggested framework provides early PCOS identification and individualized decision support without requiring complicated clinical procedures by combining machine learning-based prediction, intelligent feature selection, and explainable risk analysis in a new way inside an integrated healthcare system.

### **803.MODELLING AND PERFORMANCE ANALYSIS OF A PROTON EXCHANGE MEMBRANE FUEL CELL (PEMFC) UNDER VARYING OPERATING CONDITIONS (USING MATLAB)**

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As the global energy landscape transitions toward decarbonization, Proton Exchange Membrane Fuel Cells (PEMFCs) have emerged as a pivotal technology for zero-emission power generation. However, the commercial viability of PEMFCs is often hindered by complex internal transport phenomena and the sensitivity of electrochemical performance to varying operating conditions. This study presents a comprehensive numerical model developed in the MATLAB environment designed to analyse and predict the performance characteristics of a PEMFC under a wide range of standard operating parameters. The research employs a MATLAB-based steady-state mathematical framework to investigate the influence of key variables—including operating temperature, reactant pressure, and membrane thickness—on the cell's polarization behaviour. By leveraging MATLAB's high-performance computational capabilities, the study executes a series of iterative algorithms to quantify the dominant loss mechanisms, specifically activation, ohmic, and concentration overpotentials. The use of MATLAB's robust curve-fitting and visualization toolboxes allows for a precise correlation between theoretical losses and the resulting polarization (I-V) curves, identifying the optimal operating envelopes that maximize power density. Unlike conventional complex architectures, this work focuses on refining standard flow field models to provide a computationally efficient yet highly accurate tool for performance prediction. The MATLAB simulation results offer valuable insights into the design and thermal management of PEMFC stacks, contributing to the development of more robust and efficient hydrogen-based energy solutions for stationary and transport applications.

### **804.SMART METER-BASED ENERGY CONSUMPTION ANALYSIS IN HIGHER EDUCATION INSTITUTIONS**

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Rising energy costs and global sustainability objectives have made energy efficiency a critical priority for higher education institutions. This study presents a data-driven energy audit conducted across five academic blocks at Kumaraguru College of Technology using Schneider EcoStruxure Power

Monitoring Expert meters. Real-time monitoring data was analysed to evaluate energy consumption trends, peak demand behaviour, and power factor variations over the period 2024–2025. The results reveal a campus-wide increase in energy consumption, with Block C exhibiting the highest demand due to energy-intensive facilities. Lighting and HVAC systems were identified as major contributors, together accounting for a significant portion of the total load. The study estimates a potential campus-wide energy savings of 25–40% through interventions such as LED retrofitting, HVAC optimization, power factor correction, and IoT-based energy monitoring. The findings demonstrate the effectiveness of smart metering and analytics in enabling sustainable, data-driven energy management for academic campuses.

## **805. MULTI-MODAL SLEEP STAGE CLASSIFICATION USING MULTI-SCALE MASKED AUTOENCODER AND CONVOLUTIONAL NETWORKS**

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Sleep stage classification is key in sleep disorders analysis and improving sleep quality. Conventional methods for sleep stage classification often use single modal data and conventional machine learning approaches. However, conventional sleep stage classification methods may not capture the complexity of the patterns and characteristics of each sleep stage appropriately. Therefore, this paper proposed a new framework for multi modal sleep stage classification, by utilizing multi-scale masked autoencoders (MSMAE) and Convolutional Neural Networks (CNN), it effectively improve the accuracy and robustness of sleep stage prediction. Our proposed system uses multi-modal data, i.e. EGG, EOG and EMG signals, the system benefits from the cross-modal complementary information. The proposed system uses two stream encoder-decoder architecture. In the encoder phase, the multi scale masked autoencoders (MSMAE) model is used to extract multi-scale and hierarchal features from raw signals. The MSMAE used masked autoencoding approach to reconstruct the masked input. It allows us to learn

deep representations to capture intricate temporal and spatial structures in signals. In the decoder phase, the CNN-based stream is used to classify sleep stages from the obtained feature representation.

### **806.MULTI-CLASS EPILEPTIC SEIZURE STATE CLASSIFICATION USING CONSTANT-Q TRANSFORM BASED EEG SPECTROGRAMS AND DEEP LEARNING**

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Epileptic seizure prediction using electroencephalogram (EEG) signals plays a vital role in the early intervention and safety of patients. However, the exact classification of the seizure states is challenging due to the non-stationary and non-linear nature of the EEG signals. In this paper, the authors introduced a multi-class deep learning model that utilizes the time-frequency representation of the EEG signals to classify the seizure states. To effectively represent the frequency-dependent fluctuations in the EEG signals across different seizure states, the authors converted the one-dimensional EEG data collected from the Siena EEG database to two-dimensional Constant-Q Transform (CQT) spectrograms using MATLAB programming. Three classes of seizure states, namely Non-Seizure, Pre-Seizure, and Seizure, were extracted from the spectrograms. A systematic preprocessing and exploratory data analysis (EDA) was performed to ensure data stability and homogeneity. To evaluate classification performance, deep convolutional neural networks, namely EfficientNet-B0 and ResNet-50, are put into practice. When tested experimentally on test data that has not yet been seen, EfficientNet-B0 outperforms ResNet-50 with a classification accuracy of 95.63%, while both designs exhibit 100% sensitivity for seizure detection. Strong potential for integration into real-time EEG monitoring and early warning clinical systems is shown by the obtained results, which validate the efficacy of CQT-based deep learning models in differentiating between seizure and pre-seizure states.

### **807.MODELING AND SIMULATION OF A HYBRID RENEWABLE ENERGY SYSTEM FOR OPTIMAL POWER GENERATION**

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The increasing global demand for electrical energy and the rapid depletion of conventional fossil fuel resources have intensified the need for reliable and sustainable renewable energy solutions. However, individual renewable energy sources such as solar and wind are inherently intermittent and highly dependent on environmental conditions. To address these limitations, this mini-project focuses on the Modeling and Simulation of a Hybrid Renewable Energy System (HRES) for Optimal Power Generation, which integrates multiple renewable sources to ensure improved reliability, efficiency, and continuity of power supply. The primary aim of this project is to design, model, and simulate a hybrid renewable energy system—typically comprising solar photovoltaic (PV), wind energy systems, and an energy storage unit—to achieve optimal power generation under varying load and climatic conditions. The project involves mathematical modeling of individual components, development of an integrated system model, and simulation-based performance analysis using appropriate software tools. Optimization techniques are applied to determine the best configuration and operating strategy that minimizes power fluctuations, improves energy utilization, and reduces dependence on conventional backup sources. The relevance of this project lies in its strong alignment with current energy challenges such as energy security, grid stability, and carbon emission reduction. Hybrid renewable systems are increasingly adopted in standalone and grid-connected applications, including rural electrification, microgrids, and smart energy systems. By demonstrating how multiple renewable sources can complement each other, this project provides practical insights into efficient energy management and system optimization. The outcomes of this study are useful for researchers, engineers, and planners involved in the design of sustainable and economically viable renewable energy systems, making the project both technically significant and socially relevant.

### **808.ROLE OF INTERNAL COMMUNICATION PLATFORMS) IN SHAPING ORGANIZATIONAL CULTURE**

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The increasing reliance on digital communication platforms such as Slack and Microsoft Teams has transformed internal communication processes and organizational culture. These platforms enable real-time collaboration, transparency, and knowledge sharing, particularly in hybrid and remote work environments. However, their impact on organizational culture remains complex, influencing both positive outcomes such as engagement and transparency, and negative consequences such as communication overload and reduced interpersonal interaction. This paper develops a conceptual framework to examine how internal communication platforms shape organizational culture through mechanisms such as transparency, collaboration, and communication norms. Drawing on Media Richness Theory and Organizational Culture Theory, the study highlights the role of digital platforms in redefining workplace interactions. The paper contributes to HRM and organizational communication literature and provides practical implications for managing digital communication effectively.

### **809.AI-DRIVEN MICROSEGMENTATION FOR ZERO TRUST SECURITY IN KUBERNETES-BASED BANKING SYSTEMS**

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Financial institutions are transitioning to cloud- native and containerized architectures in order to scale up and improve operational agility. Although Kubernetes deployments improve service agility, they also introduce new internal security vulnerabilities that standard perimeter-based security solutions cannot effectively handle. Once an attacker has infiltrated the corporate network, such unregulated east-west connectivity across microservices may enable lateral movement, potentially leading to catastrophic data breaches and non-compliance-related regulatory fines in a banking institution. In response to these challenges, we’d want to introduce an artificial intelligence-based microsegmentation application that may be used to apply a Zero Trust security paradigm to financial traffic in the cloud. In order to regulate service-to-service communication and minimize internal attack surfaces, the idea is to implement Kubernetes-native microsegmentation using Calico. By applying XGBoost-based binomial analysis to obtain the typical traffic behavior through network flow statistics and anomalies that may indicate malicious activity, an anomaly detection model is used to provide extra security. The framework provides risk-conscious policy recommendations based on discovered anomalies, aids in improving network segmentation strategies, and lowers the overhead associated with manual management. Additionally, a real-time monitoring dashboard gives customers ongoing insight into anomaly notifications, policy enforcement status, and service-to-service interactions. Microsegmentation and centralized monitoring will be used to help customers improve their cloud internal security and comply with financial standards such as the payment card industry data security standard (PCI-DSS) and RBI rules through aggregated optimization of intelligent traffic analysis.

## **810.TRUSTWORTHY CYBERSECURITY SYSTEMS THROUGH EXPLAINABLE AI: A COMPREHENSIVE SURVEY OF IDS, MALWARE CLASSIFICATION, AND FRAUD DETECTION**

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The cybersecurity field has experienced significant improvements in threat detection because of the growing reliance on artificial intelligence in cybersecurity. However, the prevalent use of opaque and black box models of machine learning, leaves much in the way of concerns about trust, transparency, and accountability. Indeterminate decision processes undermine analyst confidence and interfere with forensic investigations in settings that place highly valued security concerns, thus causing significant barriers towards regulatory compliance. She was inspired by the urgency to create reliable cybersecurity tools; therefore, this paper shall offer a detailed overview of Explainable Artificial Intelligence (XAI) within the three significant spheres, including intrusion detection systems, malware classification, and fraud detection. This paper reviews learning models and their explainability techniques, datasets and the evaluation practices. Specific focus is given to model-agnostic solutions e.g. SHAP and LIME, inherently interpretable models, and their application in balancing the accuracy of detection with interpretability. The survey reveals such salient results as the domain-specific explanation requirement, the trade-offs between interpretability and performance, and the constraints related to the real-world application. Lastly, there are open challenges and directions of future research outlined, which highlights comities need explainability that can be scaled, evaluation that employs human cognition, and adversarial and invulnerability to perturbations.

## **811. QUANTUM-ENABLED ARTIFICIAL INTELLIGENCE: CHALLENGES, OPPORTUNITIES, AND ROADMAP FOR FUTURE RESEARCH**

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Quantum Computing (QC) and Artificial Intelligence (AI) are two new paradigms that are changing the course of intelligent computing systems. AI has had some success in analysing data, patterns, and the ability to make autonomous decisions. Nonetheless, the scalability of AI is increasingly reaching the limits of computation associated with conventional computing architectures, especially when it comes to high dimensionality optimisation and probabilistic learning situations. Quantum Computing, based on concepts such as superposition, entanglement and quantum parallelism, arrives with a fundamentally new paradigm that is capable of solving some of these challenges. The combination of QC and AI has spawned the field of Quantum-Enabled Artificial Intelligence, a new research field that is focused on boosting learning efficacy, optimisation, and scalability. This manuscript makes an effort to conduct a systematic review and critical analysis of the latest advances in quantum-enable AI with a special focus on quantum machine learning models, hybrid quantum-classical systems, and quantum-assisted optimisation techniques. In addition, it examines fundamental issues such as noise in qubits, hardware scalability, data encoding costs and the lack of fault-tolerant quantum architectures. A comparative analysis between the classical AI methodologies and the newly introduced quantum and hybrid methodologies is also performed focussing upon the viability of the same in the current Noisy Intermediate scale Quantum era. The study collates current research trajectories, identifies important

areas for opportunity and challenge and proposes a research road map. The results highlight the need for scalable architectures, efficient quantum algorithms, and interdisciplinary collaboration in moving quantum-enabled AI from theoretical explorations to practical implementations.

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