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Proceedings of

7th INTERNATIONAL CONFERENCE ON COMPUTATIONAL INTELLIGENCE AND INDUSTRY 5.0

27th & 28th March 2026

organized by

Department of Mechanical, Mechatronics & Electrical and Electronics Engineering

Editors

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Proceedings of

7th International Conference on Computational Intelligence and Industry 5.0

ICCII '2026

(27th and 28thMarch, 2026)

Organized by

Department of Mechanical Engineering

Department of Mechatronics Engineering

Department of Electrical and Electronics Engineering

Velammal Institute of Technology

Chennai, Tamilnadu, India

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Review Process

Papers submitted to this conference have been double-blind peer reviewed before final acceptance to the conference. Initially, abstracts were reviewed for relevance and accessibility and successful authors were invited to submit full papers. Many thanks to the reviewers who helped ensure the quality of all the submissions.

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ABOUT ICCII ’2026

The 7th International Conference on Computational Intelligence and Industry 5.0 (ICCII 2026), meticulously orchestrated by Velammal Institute of Technology's Department of Mechanical Engineering, Department of Mechatronics Engineering, and Department of Electrical and Electronics Engineering on 27th and 28th March 2026, emerged as a nexus of intellectual discourse and collaborative synergy. Attended by a diverse cohort of scholars, researchers, and industry luminaries, the conference served as a crucible for exploring the profound implications of computational intelligence in shaping the landscape of Industry 5.0. Throughout the event, participants were immersed in a rich tapestry of keynote presentations, panel discussions, and research paper presentations, each unveiling innovative approaches and cutting-edge technologies poised to revolutionize industrial practices. Key themes included the integration of artificial intelligence, machine learning, and robotics to drive efficiency, optimize processes, and enhance human-machine collaboration within the context of Industry 5.0.

Moreover, the conference fostered a dynamic environment for interdisciplinary exchange and collaboration, with attendees seizing the opportunity to forge new partnerships, share insights, and catalyze transformative initiatives. Panel discussions delved into pertinent topics such as the ethical implications of AI in Industry 5.0 and strategies for fostering innovation ecosystems that bridge the gap between academia and industry.

As the conference drew to a close, its impact rippled beyond the confines of the venue, igniting a collective commitment to harness the transformative power of computational intelligence for the betterment of society. Armed with fresh perspectives and newfound collaborations, participants departed with a renewed sense of purpose, poised to spearhead the next wave of innovation and progress in the ever-evolving landscape of Industry 5.0.

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Chairman’s Message……

Shri M. V. Muthuramalingam

It gives me immense pleasure to extend a warm welcome to all of you to the Seventh International Conference on Computational Intelligence and Industry 5.0 at Velammal Institute of Technology. As we gather here today, we embark on a journey of exploration and innovation in the dynamic intersection of computational intelligence and the evolving landscape of Industry 5.0.

The Department of Mechanical, Mechatronics, and EEE at Velammal Institute of Technology takes immense pride in hosting this prestigious event, bringing together leading researchers, practitioners, and thought leaders from around the globe. I am confident that the stimulating discussions, insightful presentations, and networking opportunities offered during the conference will inspire transformative ideas and catalyze impactful research endeavors.

Shri M. V. Muthuramalingam

Chairman

Velammal Educational Trust

Director's Message……

Shri M. V. M. Sasi Kumar

I extend a warm welcome to each and every one of you, and I wish you a rewarding and memorable experience at the Seventh International Conference on Computational Intelligence and Industry 5.0. In today's rapidly evolving technological landscape, the fusion of computational intelligence with Industry 5.0 principles presents boundless opportunities for advancement and growth. This conference serves as a platform for exploring these opportunities, fostering interdisciplinary collaboration, and driving impactful research that addresses the challenges of our time.

I am confident that the insightful discussions and presentations over the course of this conference will inspire new ideas, spark collaborations, and propel us towards a future of enhanced efficiency, sustainability, and human-machine synergy in industry.

Shri M. V. M. Sasikumar

Director

Velammal Educational Trust

Advisor’s Message……

Shri K. Razak

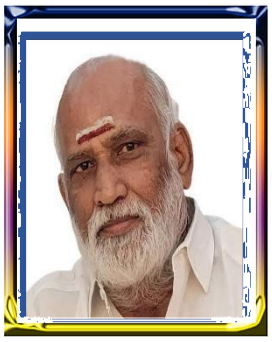
It is with great pleasure and anticipation that I extend a warm welcome to all attendees of the Seventh International Conference on Computational Intelligence and Industry 5.0 at Velammal Institute of Technology. As the conference advisor, I am honored to be a part of this esteemed gathering of scholars, researchers, and industry professionals. The theme of this conference, focusing on the integration of computational intelligence into the evolving landscape of Industry 5.0, is both timely and relevant in today's technological age. It is a testament to our commitment to fostering innovation and facilitating dialogue at the intersection of academia and industry.As we embark on this intellectual journey together.

Shri K. Razak

Advisor

Velammal Institute of Technology

Advisor's Message……



Shri M. Vasu

It is with great pleasure that I extend a warm welcome to all attendees of the Seventh International Conference on Computational Intelligence and Industry 5.0.

I am excited to witness the convergence of minds from diverse backgrounds to explore the fascinating realm of computational intelligence within the context of Industry 5.0. Your presence here reflects your dedication to innovation and your commitment to driving progress in our rapidly evolving technological landscape.

Throughout the conference, I encourage you to engage actively in discussions, share your insights, and forge meaningful connections with fellow participants. Together, let us seize this opportunity to exchange knowledge, spark inspiration, and pave the way for groundbreaking advancements in our fields.

Shri M. Vasu

Advisor

Velammal Institute of Technology

Principal’s Message……

Dr. N. Balaji

On behalf of Velammal Institute of Technology, it gives me immense pleasure to extend a warm welcome to all the distinguished participants, scholars, and industry professionals gathered here for the Seventh International Conference on Computational Intelligence and Industry 5.0.

As we convene at this prestigious event, we embark on a journey of exploration, innovation, and collaboration in the dynamic fields of computational intelligence and Industry 5.0. This conference serves as a vital platform for sharing cutting-edge research, fostering interdisciplinary dialogue, and shaping the future of technological advancements that will impact industries worldwide.I commend the Department of Mechanical, Mechatronics, and EEE for their initiative in organizing this conference and for their dedication to promoting excellence in research and education.

Dr. N. Balaji

Principal

Velammal Institute of Technology

Vice Principal's Message……

Dr. S. Soundararajan

It is my honor to extend a warm welcome to all participants of the Seventh International Conference on Computational Intelligence and Industry 5.0 at Velammal Institute of Technology.

As the Vice Principal, I am thrilled to witness the gathering of distinguished scholars, researchers, and industry experts in our pursuit of knowledge and innovation. This conference serves as a pivotal platform for exploring the intersection of computational intelligence and Industry 5.0, two areas that are reshaping the landscape of technology and industry.

I extend my gratitude to our keynote speakers for sharing their expertise and insights, and to all presenters for their contributions to advancing research and scholarship in this field.

Wishing you all a rewarding and fruitful conference experience.

Dr. S. Soundararajan

Vice Principal

Velammal Institute of Technology

Convenor’s Message……

Dr. M. S. Heaven Dani

It is my pleasure to extend a warm welcome to all participants of the Seventh International Conference on Computational Intelligence and Industry 5.0, organized by Velammal Institute of Technology. I am delighted to witness the coming together of brilliant minds to explore the intersection of computational intelligence and the evolving landscape of Industry 5.0. This conference serves as a platform for sharing insights, fostering collaborations, and driving innovation in our field.

I extend my sincere appreciation to the organizing committee for their efforts in orchestrating this conference and to our esteemed speakers for sharing their expertise with us. Your contributions will undoubtedly enrich our discussions and inspire new avenues of exploration.

Thank you for your dedication to advancing knowledge and innovation in our field.

Dr. M. S. Heaven Dani

Prof. & Head - Mechanical

Velammal Institute of Technology

Convenor's Message……

Dr. D. Magesh Babu

It gives me great pleasure to welcome you to the Seventh International Conference on Computational Intelligence and Industry 5.0, hosted by Velammal Institute of Technology.

As the Head of the Department of Mechatronics, I am excited to witness the convergence of minds from academia and industry to explore the transformative potential of computational intelligence in the context of Industry 5.0. This conference provides a unique opportunity for us to delve into the latest advancements, share our research findings, and engage in meaningful discussions that will shape the future of our fields.

To all the participants, I encourage you to actively participate in the sessions, exchange ideas, and collaborate with your peers. Your contributions are invaluable in driving innovation and pushing the boundaries of knowledge in mechatronics and related disciplines.

Dr. D. Magesh Babu

Prof. & Head - Mechatronics

Velammal Institute of Technology

Convenor’s Message……

Dr. S. Muthukaruppasamy

A hearty welcome to all attendees of the Seventh International Conference on Computational Intelligence and Industry 5.0, hosted by Velammal Institute of Technology. This conference provides a unique platform to explore the fusion of computational intelligence with the principles of Industry 5.0, shaping the future of technology-driven industries.

I extend my sincere gratitude to the organizing committee for their tireless efforts in planning and executing this conference, and to our esteemed keynote speakers for sharing their invaluable insights with us. Your contributions pave the way for meaningful discussions and collaborative endeavors that drive progress in our discipline.

Dr. S. Muthukaruppasamy

Prof. & Head - EEE

Velammal Institute of Technology

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Cordially invite you for the
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COMPREHENSIVE REVIEW OF MECHANICAL AND TRIBO-CORROSION BEHAVIOR OF INCONEL 625 FOR HIGH-PERFORMANCE APPLICATIONS

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Abstract

Inconel 625, a nickel-chromium-based superalloy, is widely utilized in aerospace, marine, and chemical industries due to its exceptional mechanical strength, corrosion resistance, and stability under extreme environments. This study investigates the mechanical, tribological, and corrosion characteristics of Inconel 625, emphasizing the synergistic effects of tribo-corrosion.. The study also explores electrochemical aspects, environmental influences, and the role of advanced coatings and surface treatments in improving performance. Experimental techniques such as tensile testing, electrochemical impedance spectroscopy, SEM-EDS, and finite element simulations were examined to provide comprehensive insights. The findings highlight the alloy's strong resistance to mechanical degradation and corrosion in aggressive environments, while also identifying conditions under which tribo-corrosion accelerates material loss. Surface modification strategies and modeling tools like FEA, CFD, and multi-physics simulations are shown to enhance predictive capability and durability optimization. This integrated approach contributes to improving the reliability and lifespan of Inconel 625 components in high-stress, corrosive, and high-temperature applications.

Keywords : Inconel 625; nickel-chromium superalloy; mechanical properties; tensile strength; hardness; fatigue; creep; tribology; wear behaviour; tribo-corrosion; corrosion resistance; electrochemical impedance spectroscopy (EIS); electrochemical behaviour; SEM-EDS analysis; finite element simulation (FEM); surface treatments; protective coatings; environmental effects; high-temperature performance; marine applications; aerospace materials

A COMPREHENSIVE REVIEW ON VIBRATIONAL ANALYSIS OF 3-D PRINTED DAMPERS

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Abstract

The advent of additive manufacturing (AM) has fundamentally transformed the engineering approach to vibration control, facilitating the transition from complex, multi-part assembly dampers to monolithic compliant mechanisms. This review paper systematically examines the design methodologies, fabrication process parameters, and performance analysis of 3D-printed dampers and vibration isolation systems. It critically evaluates the implementation of topology optimization to distribute compliance effectively within structures for chatter reduction, the development of bio-

inspired metamaterials such as carbon nanotube-mimicking joints for shock absorption, and the mechanical characterization of

lattice structures for energy dissipation. The review encompasses a broad spectrum of materials, quantifying the mechanical performance of thermoplastics including Thermoplastic Polyurethane (TPU), Polylactic Acid (PLA), Acrylonitrile Butadiene Styrene (ABS), and Polyethylene Terephthalate Glycol (PETG). Furthermore, it addresses the durability of 3D-printed concrete in aggressive environments and the structural capacity of reinforced concrete beams. Specific industrial applications are highlighted, ranging from semi-active isolation systems for shipboard equipment and particle damping in wind turbine blades to precision optics and educational vibratory mechanisms.

HEAT TRANSFER ENHANCEMENT IN A CONCENTRIC TUBE HEAT EXCHANGER USING AL_2O_3-GRAPHENE HYBRID NANOFLUID WITH VARIOUS INSERTS

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Abstract

Al_2O_3 nanoparticles offer excellent chemical stability, wide availability, and low cost, but their moderate thermal conductivity limits their heat transfer efficiency. Graphene, in contrast, possesses extremely high thermal conductivity and acts as a powerful thermal enhancer. When both materials are combined, Al_2O_3 helps maintain uniform dispersion and suspension stability, while graphene compensates for alumina's limited conductivity. This creates a hybrid nanofluid with noticeably higher thermal performance than either material used individually. As a result, the fluid becomes more effective in transporting heat, making it suitable for advanced thermal management applications.To further improve the system, custom copper inserts with extended fins are introduced into the concentric tube heat exchanger. Traditional heat exchangers have limited thermal enhancement, but the addition of inserts increasesthe effective surface area and promotes stronger convective behavior. The fin geometry increases fluid mixing and turbulence within the annular region, which significantly improves heat transfer rates. Copper is selected due to its high thermal conductivity, corrosion resistance, and ease of manufacturing, allowing quick heat diffusion through the insert structure. The study examines the performance of different fin angles, varying concentrations of the hybrid nanofluid, and multiple flow velocities under parallel flow conditions, enabling a detailed evaluation of thermal improvements.

Keywords:*Hybrid nanofluid, Al_2O_3, Graphene, Copper inserts, Heat transfer, Concentric tube heat exchanger, Parallel flow, Thermal enhancement, Fin geometry, Fluid mixing, Turbulence.*

A COMPREHENSIVE REVIEW ON COMPLIANT MECHANISMS FOR ACTIVE VIBRATION ISOLATION USING FINITE ELEMENT ANALYSIS

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Abstract

Compliant mechanisms have emerged as a transformative approach to vibration isolation in mechanical and electromechanical systems, offering advantages such as joint free motion transmission, reduced friction, lightweight construction, and improved reliability compared to traditional rigid body mechanisms.

With growing demand for compact, efficient, and high performance vibration isolation systems in domestic appliances, consumer electronics, and industrial machinery, compliant structures especially flexure based mechanisms have gained significant attention. This review provides a comprehensive analysis of compliant mechanism based vibration isolators, emphasizing their structural behaviour, material selection, and performance evaluation through Finite Element Analysis (FEA). Advanced materials, including polymer based composites reinforced with graphene oxide, copper microparticles, and other nano fillers, have demonstrated substantial improvements in damping capacity, stiffness to weight ratio, and deformationcontrol. FEA tools further enable virtual prototyping through static structural, modal, harmonic, and topology optimization analyses, ensuring effective load distribution and resonance avoidance. This review consolidates major research findings on compliant flexures, vibration attenuation mechanisms, material enhancements, and simulation driven optimization. The paper concludes by identifying existing research gaps and outlining future directions in multi material additive manufacturing, hybrid passive active vibration control, and intelligent compliant design frameworks for next generation vibration isolation systems.

INTEGRATED EXPERIMENTAL AND NUMERICAL SIMULATION ANALYSIS OF LASER WELDING PARAMETERS IN HASTELLOY X

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Abstract

Hastelloy X, a nickel-based superalloy designed for high-temperature and corrosive environments, poses significant challenges during fusion-based welding due to segregation behavior, rapid solidification, and susceptibility to residual stresses. This study integrates controlled laser-welding experiments with finite-element simulations to evaluate how focal position, laser power, and

welding speed influence weld formation, microstructure, mechanical properties, and residual stress. Microstructural characterization using OM, SEM, and EDS revealed columnar-to-equiaxed transitions governed by the thermal gradient and solidification velocity. Hardness and tensile testing showed strong correlations between grain refinement and mechanical response. Coupled thermal–mechanical simulations accurately predicted temperature fields, weld geometry, and tensile residual stress distributions, validated using X-ray diffraction. Parametric analysis identified welding speed as the most influential factor for microstructure evolution, while focal position determined penetration characteristics. The integrated experimental–numerical framework provides a robust basis for optimizing laser welding of Hastelloy X components for critical high-temperature industrial applications.

Keywords: *Hastelloy X; Laser welding; Thermal–mechanical simulation; Microstructure; Residual stress; Finite-element modeling; Welding parameters; Solidification behavior*

DEVELOPING DEFECT DETECTION SYSTEM FOR QUALITY CONTROL IN AUTOMOBILE INDUSTRY USING SMART VISION TECHNOLOGY

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Abstract

This work showcases the development of an intelligent defect detection system for enhancing the quality control processes in automobile manufacturing. Modern automobile manufacturing requires very high levels of precision and consistency in production, and traditional car body inspection methods based on manual labor can no longer meet such demands in terms of human fatigue, subjectivity, and low processing speed. Therefore, this research work develops a fully automated and reliable defect inspection framework by integrating a high-resolution smart vision camera with an AI-driven neural network model.The system includes a smart vision camera, which captures high-clarity, detailed images of automobile parts directly on the production line. Theseimages will be processed by a custom-trained deep neural network with a wide range of defect targets, such as surface scratches, dents, cracks, paint irregularities, and dimensional deviations. The neural network is trained based on an extensive dataset from defective and non-defective samples to learn distinctive patterns that helpimprove classification performance across various lighting, material, and geometric conditions.The system realizes real-time processing by incorporating various optimized image preprocessing methods, such as noise filtering, contrast enhancement, and edge detection. These steps help provide the neural network with high-quality feature inputs, which in turn improve the accuracy and reliability of defect identification. The AI-powered model provides defect

type, location, and severity as output, thus helping the manufacturer to take immediate corrective actions.Experimental evaluation in simulated and near-industrial environments proves that the proposed smart vision system significantly enhances inspection speed compared to manual inspection methods. The detection performance is consistently high with reduced false positives and missed defects. Due to its automated nature, the developed system reduces dependency on skilled inspectors, hence reducing labor costs and minimizing the effects of human error. In general, an improvement in inspection capabilities implies better quality control in production and increased customer satisfaction.The findings of this work underline that smart vision integrated with AI-based defect recognition forms a robust, scalable, and cost-effective solution for modern automobile manufacturing. The proposed system supports continuous real-time inspection, enhances operational efficiency, and ensures that every component meets stringent quality standards. The work uses an intelligent machine vision system to show the transformation of industrial automation and the elevation of quality control to a new degree of precision and reliability.

Keywords: smart vision system, defect detection, neural network, automobile quality control, machine vision, AI inspection, surface defect recognition, industrial automation.

DESIGN AND IMPLEMENTATION OF A PLC-BASED CONVEYOR BELT FOR OBJECT SORTING SYSTEM.

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Abstract

This project aims at designing and implementing a PLC-based conveyor belt object sorting system developed to classify products into categories based on colour, size, and height. The system integrates optical sensors, proximity detectors, and height measurement modules with a conveyor mechanism, thus enabling the monitoring and sorting of objects in real time as they move along the belt. Logic operations are done by the PLC; sensor feedback is processed, and actuators are triggered to divert objects precisely into their respective bins. The aim of the system is to enhance industrial automation through enhancing sorting efficiency, reduction of human errors, and ensuring a consistent speed of processing. Sorting conditions are set up with ladder logic programming to guarantee speedy and sure decision-making within the system. This project addresses modularity, scalability, and cost-effectiveness, thereby making it suitable for small- to medium-scale manufacturing and packaging industries. Laboratory tests with real objects showed great sorting accuracy with different object parameters, hence proving the efficiency of the system in dynamic operational conditions. The PLC-

based conveyor sorting system proposed here will form a practical and robust solution for industries to achieve workflow optimization, reduced labour dependency, and productivity enhancement using smart automation technologies.

MACHINABILITY OF TI-63 ALLOY BY ABRASIVE WATER JET MACHINE

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Abstract

Titanium alloy Ti-63 is widely used in aerospace, biomedical, marine, and high-performance engineering applications due to its superior strength-to-weight ratio, corrosion resistance, and biocompatibility. However, its low thermal conductivity, high chemical reactivity with cutting tools, and strong resistance to deformation make it extremely difficult to machine using conventional processes. These limitations often lead to excessive tool wear, high cutting temperatures, poor dimensional accuracy, and degraded surface quality. To overcome these challenges, this project explores Abrasive Water Jet Machining (AWJM) as a non-contact, cold-cutting alternative capable of effectively machining Ti-63 without generating heat-affected zones or mechanical tool wear. The primary objective of this study is to analyse how process parameters such as water pressure, traverse speed, stand-off distance, abrasive flow rate, and abrasive mesh size influence kerf characteristics, material removal rate, and surface integrity during AWJM. Experimental trials were performed on Ti-63 plates under various parameter combinations, and machining performance was assessed by measuring kerf top width, kerf bottom width, kerf taper, depth of cut, and surface roughness. SEM and EDS analyses were used to examine the machined surfaces and identify dominant erosion mechanisms including micro-cutting, ploughing, crater formation, striation evolution, and abrasive embedment. The results showed that higher water pressure significantly increases cutting depth and reduces taper by improving jet energy and abrasive particle momentum. Lower traverse speeds enhance surface finish by allowing more particle impacts per unit length, while optimal abrasive flow ensures stable erosion without excessive surface damage. Stand-off distance and abrasive grit size were also found to strongly influence jet coherence, kerf geometry, and surface texture. Overall, the findings confirm that AWJM is a highly effective method for machining Ti-63, providing good dimensional accuracy, minimal thermal distortion, and improved machinability when parameters are properly optimized.

MECHANICAL CHARACTERIZATION OF 904L SUPER AUSTETIC STAINLESS STEEL WELDED BY GMAW

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Abstract

Grade 904L super-austenitic stainless steel is widely used in highly corrosive environments due to its exceptional corrosion resistance and high alloy content. However, its weldability and the resulting mechanical performance require careful evaluation, particularly in critical applications such as chemical processing, marine systems, and desalination plants. In this study, Gas Metal Arc Welding (GMAW) was employed to join 904L stainless steel plates under controlled welding parameters. The mechanical characteristics of the welded joints were investigated through tensile testing, hardness profiling, and microstructural examination. The results indicate that the weld metal and heat-affected zone exhibit distinct microstructural transformations influenced by thermal cycles, which in turn affect strength and hardness. Tensile tests revealed that joint efficiency remained high, with fracture typically occurring in the softened heat-affected zone. Microstructural analysis confirmed the presence of dendritic structures in the weld metal and grain coarsening near the fusion boundary. Overall, the study demonstrates that GMAW is a viable welding technique for 904L stainless steel, producing joints with reliable mechanical performance when appropriate welding parameters are applied.

Keywords: *904L stainless steel, Super-austenitic steel, Gas Metal Arc Welding (GMAW), Weldability, Mechanical properties, Tensile strength, Hardness test, Microstructural analysis, Heat-affected zone (HAZ), Corrosion resistance.*

WEAR STUDY ON AL8011 + TIC + MICA HYBRID METAL MATRIX COMPOSITES

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Abstract

This study focuses on enhancing the wear resistance of Al8011 aluminium alloy, which is widely used in engineering applications but naturally exhibits low tribological performance. To surmount this limitation, the metal matrix hybrid composite has been fabricated by adding Titanium Carbide (TiC) and mica to Al8011, thus combining the hardness of TiC with mica's ability to reduce friction. Considering load, sliding speed, sliding distance, and mica percentage as the major influencing parameters, the tribological behaviour of the composite has been analyzed in the Response Surface Methodology framework using a Definitive Screening Design (DSD). Accordingly,

optimization of the wear performance by RSM and the Hippopotamus algorithm was carried out to identify the most influencing factors and to find out the best combination of parameters to minimize wear loss and stabilize the coefficient of friction. The experimental wear data obtained are substantiated by microstructural investigations using SEM to observe the modes of wear like abrasion, adhesion, and surface damage, while Energy Dispersive Spectroscopy confirms the elemental distribution and reinforcement presence on the worn surfaces. From the results, it can be observed that the addition of TiC and mica has considerably improved the wear resistance of Al8011 at different operating conditions. This integrated approach combining experimental design, optimization, and micrograph analysis has provided a deeper understanding of the hybrid composite's behaviours, thus contributing to the development of lightweight, durable, and wear-resistant materials for engineering applications of the modern era.

Keywords: *Al8011, TiC, Mica, Hybrid Metal Matrix Composite, Wear Resistance, Tribology, Coefficient of Friction, Wear Loss*

ADVANCED REVIEW ON ADDITIVE MANUFACTURING OF AUXETIC META-MATERIALS: DESIGN PRINCIPLES, PROCESSING PATHWAYS, AND MULTI-SCALE MECHANICAL BEHAVIOUR

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Abstract

Auxetic meta-materials, characterized by their negative Poisson's ratio behaviour, have become a critical research area due to their superior indentation resistance, enhanced shear modulus, and exceptional energy-absorption performance. The integration of additive manufacturing (AM) techniques, particularly laser powder bed fusion (L-PBF), has enabled thefabrication of highly complex metallic auxetic architectures with high resolution and structural fidelity.This review synthesizes multi-scale insights into geometry–material–process interactions, covering historical evolution, advanced auxetic classifications, AM design constraints, post-processing effects, and computational optimisation. Applications in aerospace, biomedical engineering, automotive structures, and protective equipment are discussed. Challenges such as porosity, surface roughness, fatigue reliability, and scaling limitations remain critical. Future pathways include functionally graded auxetics, hybrid multi-material printing, AI-based topology optimisation, and bio-inspired architectures.This article integrates previous literature with new scientific insights to provide a comprehensive reference for researchers and industry professionals.

WEAR MAP DEVELOPMENT BY USING EXPERIMENTAL AND MACHINE LEARNING APPROACH

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Abstract

Wear prediction in mechanical systems is usually slow, experimentally expensive, and often inaccurate when traditional analytical methods are used. This project addresses that limitation by developing wear maps using a combined experimental and machine learning (ML) approach. Controlled laboratory experiments were conducted by varying key parameters such as load, sliding speed, time, and material pair. The collected data was used to generate baseline wear behaviour and identify dominant factors influencing wear rate.Using this experimental dataset, ML models—such as regression algorithms and decision-tree-based methods—were trained to predict wear rate under unseen operating conditions. The models were evaluated using accuracy metrics, and the best-performing model was used to construct high-resolution wear maps. These maps enable fast, reliable prediction of wear behaviour across a wide range of conditions without additional physical testing.Wear is one of the most critical failure mechanisms in mechanical systems, directly affecting reliability, maintenance cost, and component life. Conventional wear prediction methods rely heavily on empirical equations and prolonged testing, which limits accuracy and scalability when operating conditions change. This project overcomes these limitations by integrating experimental analysis with machine learning (ML) to develop a high-accuracy wear map capable of predicting wear rate across a wide

range of conditions

Keywords: *traditional analytical methods, machine learning (ML) approach, experimental dataset, high-resolution wear maps, mechanical systems, Conventional wear prediction, predicting wear rate.*

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EXPERIMENTAL ANALYSIS OF MECHANICAL PROPERTIES OF FDM-PRINTED THERMOPLASTICS (PLA/PEEK/ABS) WITH VARYING INFILL DENSITIES AND PATTERN CONDITIONS

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Abstract

This study presents an experimental analysis of the mechanical properties of Fused Deposition Modelling (FDM)-printed thermoplastics—Polylactic Acid (PLA), Polyether Ether Ketone (PEEK), and Acrylonitrile Butadiene Styrene (ABS)—under varying infill densities and pattern conditions.[1] The investigation aims to establish correlations between internal structural parameters and mechanical performance to support material and process optimization for additive manufacturing applications. Standardized test specimens were fabricated at infill densities of 20%, 40%, 60%, and 80% using rectilinear, honeycomb, and hexagonal patterns. Mechanical testing included tensile, compressive, and impact evaluations performed according to ASTM standards, while microscopic analysis (SEM) was used to assess interlayer bonding and fracture morphology. [6] Results revealed that increasing infill density significantly enhances tensile and compressive strength for all three thermoplastics, with diminishing improvements beyond 80% density. Infill pattern also demonstrated a substantial influence: honeycomb structures provided superior energy.

ANALYSIS OF THERMAL PROPERTIES OF NATURAL FIBER REINFORCED POLYMER COMPOSITES FOR THERMAL PROTECTION

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Abstract

This study explores natural fibers are increasingly being utilized to create sustainable, high-performance composites for applications in acoustics, automotive, and construction. provides a critical analysis of research into the thermal properties and potential for thermal protection offered by sustainable natural fiber reinforced polymer (NFRP) composites. The review systematically synthesizes existing knowledge on the thermal stability of natural fiber/epoxy systems, which have been shown to possess enhanced thermal properties over neat resin systems, and the thermal mechanism of APP, which typically operates by promoting char formation to insulate the substrate from heat. While extensive literature exists on various natural fiber-epoxy composites (such as jute, flax, and sisal) and the effect of phosphorus-based flame retardants, a significant research gap on Thermal Conductivity, Cone Calorimetry Test, X-Ray Diffraction test, Heat Deflection Test, Dynamic mechanical test which measures thermal stability and morphology of the composites.

Keywords: *Natural fibres, Ammonium Polyphosphate, natural composites, Thermal Properties, thermal stability,*

A Review on Thermal Properties of Natural Fiber Reinforced Polymer Composites for Thermal Protection

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Abstract

This study explores natural fibers are increasingly being utilized to create sustainable, high-performance composites for applications in acoustics, automotive, and construction. provides a critical analysis of research into the thermal properties and potential for thermal protection offered by sustainable natural fiber reinforced polymer (NFRP) composites. The review systematically synthesizes existing knowledge on the thermal stability of natural fiber/epoxy systems, which have been shown to possess enhanced thermal properties over neat resin systems, and the thermal mechanism of APP, which typically operates by promoting char formation to insulate the substrate from heat. While extensive literature exists on various natural fiber-epoxy composites (such as jute, flax, and sisal) and the effect of phosphorus-based flame retardants, a significant research gap on Thermal Conductivity, Cone Calorimetry Test, X-Ray Diffraction test, Heat Deflection Test, Dynamic mechanical test which measures thermal stability and morphology of the composites.

Keywords: Natural fibres, Ammonium Polyphosphate, natural composites, Thermal Properties, thermal stability,

Real-Time Dual-Sensor IOT Milk Adulteration Detection and Concentration Estimation Using Multispectral-EC Sensor Fusion on an ESP32 Edge Platform

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Abstract

Milk adulteration impairs food safety and public health and is a major issue in the lessprivileged regions of the world, where the monitoring of quality is minimal. An enhanced Internet of Things (IoT)-enabled milk adulteration detection system that conjoins a multispectral sensor AS7265x and an electrical conductivity (EC) sensor with the ESP32 microcontroller for real-time,

reagent-free analysis is presented in this research paper. The AS7265x sensor with 18 spectral channels ranging from the visible to near-infrared (410–940 nm) can quickly detect the change in milk optics caused by the contamination of water, detergent, and urea. The EC sensor changes the analysis by measuring ionic concentration changes, thus offering a dual-parameter approach that improves detection accuracy. The ESP32 module, after processing the sensor data, transmits it wirelessly to the Blynk IoT dashboard for easy monitoring and data visualization. The experimental results show that the hybrid system proposed outperforms the existing optically detection methods in terms of sensitivity and reliability, while portability and low power consumption are maintained. Such a smart sensing architecture gives a practical and scalable way of supporting food safety and supply chaintransparency through on-site milk quality checks.

Keywords—Milk adulteration, Internet of Things, multispectral sensing, AS7265x, EC sensor,ESP32, Blynk, real-time detection.

Mechanical and wear behaviour of thermally sprayed nano tungstencarbide-cobalt coated AISI 4140 steel

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Abstract

AISI 4140 which is a medium carbon steel has substantial mechanical properties thatlead to its application in the engineering sectors like machine tools. The literature review shows that only few researchers have carried out investigation to examine the mechanical and wear behavior of coated 4140 steel. Also, many researchers have carried out tribological study of steels, coated with ceramics through high velocity oxygen fuel (HVOF) process.AISI 4140 steel is naturally wear resistant, but its applications involve huge frictional forces.Therefore, there is a need to increase the wear resistance of 4140 steel by coating. So, the novelty of this research work is to increase the wear resistance of AISI 4140 steel by coating it with nano cermet through HVOF process. The objective of this research work is to find out the optimal HVOF process parameter levels that yield high wear resistance and hardness of the resultant coating. The investigation reveals that increase in both feed rate and spray distance with less traverse speed yields high hardness in the resultant coating. The nano WC-12Co coating with the optimal HVOF process parameter levels has reduced the wear rate by 35.68%, when compared with that of uncoated AISI 4140 steel specimen.

Keywords: AISI 4140 steel, Coating, HVOF, Thermal spray, Nano, WC-12Co, Hardness, Wear rate, SEM, Fuzzy model

Adaptive Gated Deep JSCC for Image Classification and Recovery with Adam-Based Learning Rate Scheduling

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Abstract:

Deep Joint Source and Channel Coding (Deep JSCC) is a network–based strategy thatunifies image compression and wireless transmission within a single, end-to-end trainable framework. This study presents two enhanced Deep JSCC architectures aimed at achieving efficient image reconstruction and accurate semantic preservation under noisy channel conditions. The first framework, termed Baseline Deep JSCC, employs a convolutional encoder–decoder architecture optimized through a hybrid objective that balances image fidelity and classification accuracy. The second framework, known as Adaptive Gated Deep JSCC, introduces a dynamic gating mechanism that adjusts the encoding strength according to real-time Signal-to-Noise Ratio (SNR) variations, thereby improving robustness against channel fluctuations. Both models are implemented using the DeepLearning 4J library in Java, ensuring reproducibility and cross-platform compatibility. Experimental evaluation on the MNIST dataset demonstrates that the Adaptive Gated Deep JSCC consistently achieves higher Peak Signal-to-Noise Ratio (PSNR) and classification accuracy compared to the baseline, while maintaining computational efficiency. Overall, the proposed adaptive framework provides a resilient and resource-efficient solution for semantic image transmission across unreliable or bandwidth-constrained communication channels.

Keywords: Deep Joint Source–Channel Coding (DeepJSCC), Semantic Communication, Adaptive Gating, Image Reconstruction, Peak Signal-to-Noise Ratio (PSNR), Classification Accuracy, Wireless Image Transmission.

SUSTAINABLE POWER GENERATION USING INLINE HYDRO TURBINES AND SOLAR PV

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ABSTRACT

This project presents a prototype hybrid energy system that harnesses both hydropower and solar energy to provide sustainable electricity generation. The design integrates a turbine within a water pipeline that channels flow from the river to the city. As water moves through the pipeline, it strikes the turbine blades, causing rotation and enabling mechanical-to-electrical energy conversion. To optimize efficiency, custom-designed blades are employed to minimize water resistance, ensuring smooth flow while maximizing rotational output. In addition to hydropower, solar panels are incorporated to supplement energy production, thereby enhancing reliability and overall capacity. This dual-source approach ensures continuous energy availability, even during periods of reduced water flow or limited sunlight. The prototype demonstrates a practical solution for decentralized renewable energy generation, combining mechanical innovation with solar integration. Such systems hold promise for urban and rural applications, contributing to sustainable development and reducing dependence on conventional fossil fuels.

Keywords: Hybrid Energy, Hydropower, Solar Integration, Turbine Blade Design,Sustainable Electricity

HYBRID SOLAR AND WIND POWERED LAMPOST

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ABSTRACT

This project presents the development of a low-cost, sustainable solar–wind hybrid renewable energy system designed to maximize energy harvesting through a single-axis solar tracking mechanism and an Archimedes spiral wind turbine. The system integrates an Arduino-based solar tracker using LDR sensors to continuously orient the solar panel toward peak sunlight, thereby increasing solar radiation capture throughout the day. To complement this, a PVC-constructed Archimedes turbine drives a DC generator capable of producing power even at low wind speeds, ensuring additional energy output during cloudy or low-light conditions. The generated power from both sources is regulated through a solar charge controller and stored in a 12 V, 8 Ah battery, enabling stable and uninterrupted energy supply. Testing confirmed that the solar tracker improved panel efficiency significantly compared to a fixed-panel setup, while the wind turbine contributed supplementary charging during fluctuating weather. Overall, the hybrid system demonstrates an efficient, environmentally friendly, and scalable solution for decentralized applications such as lamp

posts, rural lighting, and educational models, reinforcing the importance of hybrid renewable technologies in promoting sustainable energy access.

Keywords: Solar tracking, Wind turbine, Hybrid energy system, Arduino, LDR sensor,Sustainable energy.

HYBRID SOLAR-PIEZOELECTRIC ENERGY HARVESTING BUS STOP FOR SUSTAINABLE POWER GENERATION

Rahul S, Sridharsan A, Kavin Nilavan P, Madhanraj S, Dr. T. Rajkumar

ABSTRACT

This project presents the design and development of a hybrid solar–piezoelectric energy harvesting bus stop aimed at providing a sustainable and decentralized power solution for urban public infrastructure. The system integrates a 5W photovoltaic panel and piezoelectric floor tiles to capture both solar radiation and mechanical vibrations generated by pedestrian footsteps. A dual-layer ventilated solar

roof is introduced to enhance panel efficiency by reducing heat accumulation, while a vibration-multiplier piezoelectric arrangement improves electrical output from footstep-induced pressure. The harvested energy is regulated through a solar charge controller and stored in a 12V battery, which powers low-energy applications such as lighting. The prototype demonstrates the feasibility of combining multiple renewable sources within a compact structural model, highlighting its potential for

implementation in high-footfall public spaces. Overall, the project showcases an efficient, low-cost approach to enhancing urban sustainability through hybrid energy harvesting.

Keywords: Hybrid Energy Harvesting, Solar Photovoltaics, Piezoelectric Sensors, Sustainable Infrastructure, Smart Bus Stop, Decentralized Power.

A Novel design for space optimizing wind and solar power generation

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ABSTRACT

The rapid increase in global energy demand and the limitations of available land have intensified the need for compact and efficient renewable-energy systems. This project presents a novel hybrid design that integrates solar photovoltaic panels with a vertical-axis wind turbine (VAWT) in a single, space-optimized structure. The design focuses on maximizing power output per unit area by strategically combining both technologies without compromising their individual performance. Computational modeling and prototype testing are used to analyze energy efficiency, airflow interaction, structural stability, and overall system reliability. Results demonstrate that the integrated configuration can increase total energy generation by utilizing solar irradiation during the day and wind resources both day and night, providing a more continuous power supply. The compact footprint makes the system suitable for urban rooftops, agricultural fields, and remote locations where space is a key constraint. This innovative approach highlights the potential for scalable, dual-source renewable-energy solutions that support sustainable development while minimizing land usage

Keywords: Hybrid Renewable Energy, Solar Photovoltaic, Vertical Axis Wind Turbine, Space Optimization, Dual Power Generation, Sustainable Energy Systems

SOLAR POWERED SAFETY BACKPACK WITH AN ECOCHARGER

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ABSTRACT

The Solar-Powered Backpack with an Eco Charger is an innovative, ecofriendly,portable energy system integrating solar power generation, energy, storage, and smart electronic features within one wearable backpack. The device includes a solar panel mounted on the outside of the backpack that captures sunlight and converts it into electrical energy, having an internal rechargeable battery pack to stock the captured energy, and an intelligent power management circuit with a DC-DC power booster that enhances and stabilizes voltage output for different connected devices. This backpack will provide several utilities to the user, comprising USB charging ports for powering up mobile devices, an LED Light. For the safety and communication of a person, the backpack has a GPS tracking module operating with Wi-Fi assistance to raise the precision of location determination, SOS integrated with the SIM-based communication module that may send alerts of emergencies and current live locations to pre-set contacts. Such a smart backpack will be helpful for travelers, students, and outdoor explorers, and also for those people living in areas where access to conventional power source.

SMART AUTOMATIC CLEANING MECHANISM FOR DUST MITIGATION IN PHOTOVOLTAIC SOLAR PANELS

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ABSTRACT

Dust accumulation on Photovoltaic (PV) solar panels is one of the major factors responsible for power loss, often reducing the panel efficiency by 20–40% in highly polluted or arid environments. Frequent manual cleaning is labour-intensive, unsafe, and not feasible for large solar farms. The system incorporates an Arduino-based controller that continuously monitors environmental and surface conditions through

integrated sensors such as dust sensors, LDRs, or time-based scheduling. When dust deposition reaches a critical level, the controller activates a relay-driven mechanism that sequentially operates a DC water pump and a DC wiper motor. Pressurized water is sprayed onto the panel surface through nozzles to loosen dust particles, followed by a soft motorized wiper sweeping across the panel to remove remaining contaminants. This coordinated cleaning action ensures uniform coverage and avoids micro-scratches on the panel glass. The mechanism is designed to operate on low power, making it compatible with standalone PV systems.

Keywords:Automatic Solar Panel Cleaning, Design the Frame, Fix the Roller, Reduce man power.

A Non Invasive Detection of Congenital Insensitivity to Pain and Anhidrosis Using Wearable Sensors

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Abstract:

Congenital Insensitivity to Pain with Anhidrosis (CIPA) is a rare hereditary sensory and autonomic neuropathy characterized by the inability to perceive pain and absence of sweating, leading to unnoticed injuries, fractures, burns, and a high risk of hyperthermia due to impaired thermoregulation. Early diagnosis is critical, especially for infants and young children who cannot verbally express discomfort. However, existing diagnostic methods such as genetic testing and sweat gland assessment are often expensive, time consuming, and inaccessible in rural or low-resource regions. This study proposes a compact, non-invasive wearable system designed to enable early detection and continuous

physiological monitoring of CIPA related symptoms. The wearable device integrates thermistors for skin and ambient temperature measurement, a humidity sensor for assessing environmental conditions, and a Galvanic Skin Response (GSR) sensor to detect sweat gland activity. By analyzing changes in skin temperature, environmental temperature, and sweat activity, the system identifies key abnormal physiological patterns such as rising body temperature without sweating and lack of skin conductance variation. The vibration motor provides instantaneous tactile feedback as an alternative alert mechanism for patients with Congenital Insensitivity to Pain with Anhidrosis (CIPA), who lack pain and temperature sensation. The motor is triggered upon detection of abnormal physiological conditions, such as elevated skin temperature without sweating, thereby enabling timely intervention by caregivers. Upon detecting irregularities, the device generates timely alerts through an onboard buzzer and LED indicators, enabling prompt medical attention. The system is lightweight, child friendly, and designed using safe, non-invasive materials suitable for continuous monitoring of infants and children. Designed to be low-cost, easy to operate, and suitable for underserved regions, the proposed wearable device supports early identification of CIPA, reduces preventable complications, and enhances clinical decision-making for this rare and challenging conditions.

Keywords: Congenital Insensitivity to Pain with Anhidrosis (CIPA), Wearable Sensors, Thermistors, GSR Sensor, Sweat Activity, Humidity Sensor.

STUDY ON CRYOGENIC CO_2 AND CARBON QUANTUM DOTS AS LUBRICANTS FOR TURNING DSS STEEL

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ABSTRACT

This project investigates the use of cryogenic CO_2 and carbon quantum dots (CQDs) as innovative lubricants for machining DSS2205(Duplex stainless steel), an alloy widely valued for its high strength, corrosion resistance, and hardness, yet difficult to machine due to its work-hardening tendency and low thermal conductivity. Conventional cutting fluids often fail to sufficiently control heat and friction, causing faster tool wear and poor surface finish. Cryogenic CO_2 provides efficient, eco- friendly cooling through rapid evaporation, while CQDs act as nano-lubricants, forming stable protective films that significantly reduce friction and wear. The study includes chemical characterization of the material, synthesis and testing of CQDs, and CNC turning under four distinct cooling/lubrication conditions: dry, oil, CQDs, and cryogenic CO_2. Measurements of cutting temperature and surface roughness reveal that both CQDs and cryogenic CO_2 dramatically improve machining performance by lowering temperatures and enhancing surface quality compared to

traditional methods. These results demonstrate the promising potential of combining advanced cooling and nanotechnology-based lubrication to improve tool life, machining efficiency, and sustainability when working with challenging DSS2205(Duplex stainless steel).

DESIGN AND STUDY OF UAV USING IONIC PLASMA THRUSTER

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ABSTRACT

The rapid advancement in unmanned aerial vehicles (UAVs) has created a demand for efficient, silent, and low-maintenance propulsion systems. This project explores the design and study of a UAV integrated with an ionic plasma thruster, a propulsion technology that generates thrust by ionizing a neutral gas and accelerating the ions using electric fields. Unlike conventional propellers, ionic plasma thrusters have no moving parts, produce minimal noise, and offer high energy efficiency. The primary objectives of this study include the design of a miniaturized ion thruster suitable for UAV integration, understanding the working principles of ion acceleration, and analyzing the performance characteristics such as thrust, ion exhaust velocity, and power consumption. A combination of theoretical calculations, performance simulations, and experimental setup with safe laboratory-scale ion thrusters has been employed. Results indicate that while current UAV-scale ionic thrusters, they can effectively assist conventional propulsion, reduce drag, and enhance aerodynamic stability. The study demonstrates the feasibility of hybrid UAV designs that leverage ionic propulsion for noise reduction, energy efficiency, and flow control. This research lays the groundwork for future high-efficiency UAVs, emphasizing the potential of ionic plasma technology as a next-generation propulsion system.

A STUDY ON CRYOGENIC CO_2 AND CARBON DOPED SILVER QUANTUM DOTS: A NOVEL LUBRICATION APPROACH

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ABSTRACT

The rapid advancement of additive manufacturing (AM) has facilitated the production of intricate Ti6Al4V titanium alloy components with high material efficiency and design flexibility. However, post-processing operations, particularly machining, continue to pose significant challenges due to the alloy's poor machinability. This results in elevated cutting

temperatures and accelerated tool wear, which adversely affect the overall manufacturing performance and cost-effectiveness. This study investigates the use of carbon-doped silver quantum dots as an innovative nano- lubricant to improve the machinability of additively manufactured Ti6Al4V cylindrical components. A series of controlled experiments were performed under various cutting conditions to compare conventional lubrication with quantum dot-enhanced lubrication systems. Key machining parameters, including cutting temperature and tool wear, were systematically monitored and analyzed to evaluate the effectiveness of the proposed lubrication approach in mitigating the machining challenges associated with Ti6Al4V titanium alloy.

Emotion-Adaptive Industrial Robots Using Multimodal Deep Learning for Human-Centric Industry 5.0 Systems

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ABSTRACT

Industry 5.0 emphasizes human-centric, intelligent, and collaborative manufacturing environments where machines dynamically adapt to human needs. This paper proposes a Multimodal Emotion- Adaptive Robotics Framework designed to enhance safety, productivity, and worker well-being in smart factories. The proposed system integrates three complementary modalities for robust emotion recognition: facial expression features using the FER-2013 dataset, vocal emotion cues using the RAVDESS dataset, and body-pose dynamics extracted through OpenPose skeletal keypoints. A hybrid deep learning architecture—comprising CNNs for facial analysis, Transformer-based encoders for speech emotion recognition, and LSTM modules for temporal pose modeling—achieves accurate and real-time multimodal fusion. The robot's behavior controller adapts interaction speed, force, proximity, and task allocation based on the detected emotional state, enabling empathetic and context-aware human–robot collaboration. Experimental evaluations across FER-2013, RAVDESS, and OpenPose-derived sequences demonstrate improved recognition accuracy, reduced operational errors, and enhanced worker comfort compared to unimodal baselines.The proposed approach introduces a comprehensive human-awareness adaptation loop, offering a scalable design blueprint aligned with Industry 5.0 principles of personalization, resilience, and safety. This work contributes to the development of next-generation industrial robots capable of perceiving, understanding, and responding to human emotions—making factories not only intelligent but truly human-centric.

A QUANTUM GENERATIVE MODEL FOR MULTI-DIMENSIONAL TIME-SERIES TO ANALYZE FINANCIAL DATA

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Abstract

Despite proposing a quantum generative model for time series that successfully learns correlated series with multiple Brownian motions, the model has not been adapted and evaluated for financial problems. In this study, a time-series generative model was applied as a quantum generative model to actual financial data. Future data for two correlated time series were generated and compared with classical methods such as long short-term memory and vector autoregression. Furthermore, numerical experiments were performed to complete missing values. Based on the results, we evaluated the practical applications of the time-series quantum generation model. It was observed that fewer parameter values were required compared with the classical method. In addition, the quantum time-series generation model was feasible for both stationary and nonstationary data. These results suggest that several parameters can be applied to various types of time-`series data.

Keywords : Quantum generative model, time-series generation, correlated time series, financial data modelling, Brownian motion, long short-term memory (LSTM), vector autoregression (VAR)

A Decision Tree-Based Model for Academic Project Suggestions

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ABSTRACT

This paper presents a machine learning-based system for recommending academic project titles based on students' skill profiles. Using binary indicators for Python, Data Analysis, Web Development, and Machine Learning, we trained Decision Tree and Random Forest classifiers on a curated dataset of 20 labeled projects. The system achieved up to 100% accuracy on test samples and highlighted Web Development and Data Analysis as the most influential features. The proposed model offers a scalable solution for personalized project guidance in academic settings.

KEYWORDS

Project Recommendation, Machine Learning, Decision Tree, Random Forest, Student Skill Profiling, Feature Importance

INTELLIGENT SHOPPING CART WITH REAL-TIME BILLING AND PRODUCT NAVIGATION

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ABSTRACT

The Intelligent shopping cart Turns Regular Carts into Self-Checkout Machines. A simple retrofit kit was developed for existing shopping carts that lets customers scan items on a handle barcode reader, drop them in the basket, and see their bill update on their own phone. A weight sensor under the basket checks each item matches what was scanned before adding it no RFID tags or fancy cameras needed, No RFID tags needed. Originally designed during COVID to cut contact at checkout, it now just makes shopping faster. Customers get live billing, product locator as maps for finding stuff, shopping lists, and phone payments. Stores save on cashiers and get accurate billing without the need for expensive smart carts. Piloted with 6 carts: 40% faster checkout, 98% accurate, Stores save: 2 cashiers × ₹15K/month = ₹3.6L/year, Perfect for busy Indian supermarkets wanting queue-free shopping without spending to much of money.

Keywords: Smart Trolley, Load-Cell verification, Barcode Scanning, IOT Retail, Retrofit Checkout, Queueless shopping.

An Increasing Battery Life Under Pulse Loads by Using a Battery-Ultracapacitor Hybrid Energy Storage System

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Abstract:

In this work, a battery-ultracapacitor hybrid energy storage system (HESS) for pulsed loads (PL) is presented. The battery powers the constant portion of the load, while ultracapacitors (UCs) operate the pulse portion. Ultracapacitors (UC) store energy based on the square of their voltage. For

this reason, an active parallel hybrid topology with two bidirectional converters (BDC) is used here, giving UC a distinct BDC to regulate its voltage between an upper and lower limit as needed. To give the battery

separate control, the other converter is linked between the battery and DC-link. By regulating the operating modes of BDCs, where the voltage of the UC and the battery&39;s state of charge are control variables, a MATLAB/Simulink model is created to reduce the parameters that impact battery life, such as capacity rate, depth of discharge, and temperature rise due to PL. Feedback control keeps the output voltage across the load consistent. The suggested system is 56% less expensive than its competitors, according to a thorough comparison of battery-alone, UC-alone, and battery-UC hybrid modes. According to the analysis, the proposed HESS reduces the lead-acid battery's capacity by 50%, which would otherwise be required to endure the pulsating loads. Additionally, by hybridizing a high-voltage lithium-ion battery pack with a UC bank, the HESS's performance is tested for electric vehicle (EV) loads, confirming its viability for EV applications.

Key Words: Ultracapacitors (UCs), Pulsed loads (PL), bidirectional converter, hybrid energy storage system (HESS), electric vehicles (EVs).

MULTIMODAL AI FRAMEWORK FOR EARLY OSTEOPOROSIS RISK PREDICTION USING KNEE X-RAY IMAGES AND CLINICAL DATA

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Abstract:

Osteoporosis is a progressive skeletal disorder characterized by reduced bone density and increased fracture risk, often remaining undiagnosed until fractures occur. Early identification of osteoporosis and osteopenia is critical for preventing severe bone-related complications; however, conventional diagnostic techniques such as dual-energy X-ray absorptiometry (DXA) are costly and not suitable for large-scale screening. This paper proposes a multimodal artificial intelligence–based framework for early osteoporosis risk prediction by integrating knee X-ray image analysis with patient clinical data. A custom Convolutional Neural Network (CNN) is employed to automatically extract bone texture and structural features from knee X-ray images, while a machine learning model analyzes clinical risk factors including age, gender, and body mass index. The outputs of both models are combined using a weighted decision-level fusion strategy to perform multiclass classification into normal, osteopenia, and osteoporosis categories. To enhance robustness and generalization, publicly available knee radiograph datasets are incorporated for improved feature learning. A web-based

application is developed to enable real-time prediction and provide an associated confidence score for clinical decision support. The proposed framework demonstrates the effectiveness of multimodal AI for accessible and early-stage osteoporosis screening.

Keywords: Osteoporosis, Osteopenia, Knee X-ray, Convolutional Neural Network, Machine Learning, Multimodal Fusion

Finite Element Analysis and Characterization of Titanium alloy (Ti-6Al-4V)and 316L Stainless Steel Composites for shoulder joint

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ABSTRACT

This research investigates the suitability of titanium alloy (Ti-6Al-4V) and 316L stainless steel composites for shoulder joint artificial limb by studying the characterization of material, mechanical behaviour, and finite element analysis (FEA). Microstructural study has proved a refined dual-phase α-β morphology in Ti-6Al-4V and high carbon 316L stainless steel base on its mechanical behaviours. Further, the tensile and hardness tests have confirmed that the superior specific strength, resistance against fatigue, and corrosion performance of Ti-6Al-4V compared to 316L stainless steel has investigated, which offered higher ductility and cost-effective method. FEA of a 3-D shoulder implant model has demonstrated lower von-Mises stress, reduced displacement, and improved safety factor of Ti-6Al-4V that used under biomechanical loading conditions representative of shoulder mobility. Ti-6Al-4V was widely used for shoulder implants because of its good biocompatibility, corrosion resistance, and high strength-to-weight ratio. It also nearly matched the elastic modulus of bone and reduced stress shielding. However, 316L stainless steel is ideal for load-bearing and movable parts due to its exceptional toughness, wear resistance, and affordability. By Combining these materials in composite that aims to leverage the lightweight and biological application of titanium that helps to enhance the durability and wear performance of stainless steel. Also, these composites can enhance life of implant, reduce wastage, and improve overall joint performance, making them promising solution for advanced
shoulder joint implants.

Keywords: Finite Element Analysis, Ti-6Al-4V, 316L SS, Shoulder Joint

An Autonomous Multi-Agent Analytics System for Industry 5.0

Decision Support

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ABSTRACT

In data-focused settings, deriving valuable insights from extensive and varied datasets continues to be a lengthy and skill-reliant undertaking. Conventional data analytics processes depend significantly on manual or semi-automated techniques for cleaning, pre-processing, visualizing, interpreting, and generating reports, resulting in inefficiencies and restricted scalability. This paper introduces an Autonomous Analyst System, an AI-based multi-agent framework designed to automate comprehensive data analytics with minimal human involvement to tackle these challenges. The suggested system utilizes Agentic Artificial Intelligence through the CrewAI framework, wherein specific agents work together to replicate the entire workflow of a human data analyst. The system independently carries out data cleaning, statistical analysis, exploratory visualization, insight generation, and structured report production for any CSV dataset. The analytical pipeline utilizes Python, incorporating Pandas and NumPy for data manipulation, Matplotlib and Seaborn for graphical representation, and Scikit-learn for statistical tools. A Large Language Model based on Groq is utilized to create contextual insights and suggestions, while CrewAI facilitates smooth task collaboration among agents. Experimental findings show a notable decrease in analysis duration and human input, while maintaining consistency, clarity, and independence from specific domains. The suggested framework shows great promise for scalable automated analysis in business intelligence, healthcare, and financial sectors.

Keywords: CrewAI, Multi-Agent System, AI for Automation, Data Analytics

AI-Powered Computational Intelligence Models for Resolving

Unpredictable and Dynamic Transportation Issues in Intelligent Logistics Systems

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Sri Chandrasekharendra Saraswathi Viswa Mahavidyalaya

Abstract

The growing complexity of modern logistics systems, characterized by fluctuating demand, volatile transportation costs, and unpredictable disruptions, has challenged the capabilities of traditional operations research (OR) methods. This study proposes an AI-powered computational intelligence framework for addressing unpredictable and dynamic transportation problems within intelligent logistics systems. Unlike conventional static optimization models, the proposed framework

leverages Artificial Intelligence (AI), Machine Learning (ML), and Computational Intelligence (CI) techniques to enable adaptive, real-time, and data-driven decision-making in transportation planning and optimization. The framework integrates evolutionary algorithms (Genetic Algorithms, Differential Evolution), swarm intelligence (Particle Swarm Optimization, Ant Colony Optimization), and reinforcement learning (RL) to dynamically reconfigure transportation routes, allocations, and costs based on real-time conditions. Additionally, fuzzy logic systems are employed to manage uncertainty and imprecision in demand forecasting, supply variations, and travel times. By coupling deep learning prediction models (LSTM, Graph Neural Networks) with heuristic optimization layers, the system continuously learns from operational data to improve performance over time. The inclusion of IoT-enabled data collection and digital twin simulation allows for real-time monitoring, scenario analysis, and adaptive model recalibration—key capabilities for smart, Industry 5.0-ready logistics environments. Experimental validation using simulated logistics data demonstrates that the hybrid AI-CI approach outperforms classical optimization techniques in terms of cost efficiency, computational time, and resilience to disruptions such as sudden demand shifts or transport delays. The framework's modular design enables scalability across multiple transportation modes and supply chain networks, making it suitable for application in smart cities, sustainable supply chains, and autonomous distribution systems.

Personalized Career Planning Using An Intelligent Recommendation System With Dynamic Roadmaps

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Abstract

Career uncertainty affects 70-80% of students despite existing AI prediction systems achieving 87-97% accuracy. However, current solutions remain limited to diagnostic outputs, failing to provide actionable learning pathways. This paper presents a comprehensive AI career guidance ecosystem that addresses this critical gap through an integrated Random Forest classifier (90%+ accuracy) coupled with a Learning Management System (LMS). The proposed system employs a 12-question psychometric assessment (Holland Code + Big Five personality traits) processed through feature-engineered inputs to generate personalized career recommendations alongside immediate skill gap analysis and structured learning modules. Validated against 8 benchmark studies (IJSRCSEIT 97.2%, IEEE 97%, IJSART 92.3%), our Random Forest model demonstrates superior handling of mixed categorical-numeric data while maintaining high interpretability. Key innovations include end-to-end transformation from career prediction to skill acquisition, gamified LMS integration with

progress tracking, scalable three-tier architecture (React → Flask → MySQL), and real-time deployment (<500ms prediction latency). Evaluation on 2,000 synthetic student profiles confirms 88-92% accuracy with F1-scores of 0.89-0.92. This system transforms static career counseling into a dynamic professional development platform, offering universities and students an actionable solution for improved placement outcomes and career readiness.

Keywords: Career Recommendation, Random Forest, Psychometric Assessment, Learning Management System, Student Placement

Web-Based Skin Cancer and Skin Disease Detection Using Image Analysis and Machine Learning

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Abstract

Skin diseases are among the most common health conditions worldwide, and early diagnosis plays a crucial role in effective treatment and prevention of severe complications. Recent advances in artificial intelligence, particularly deep learning, have shown promising results in automated skin disease classification using medical images. However, many existing systems focus primarily on prediction accuracy while neglecting reliability assessment and explainability, which are critical for real-world clinical adoption. To address these limitations, this paper presents an Intelligent Skin Disease Diagnosis System with Reliability- Aware Explainable AI.The proposed system utilizes a hybrid architecture that combines deep learning and machine learning techniques. A pre-trained MobileNetV2 convolutional neural network is employed as a feature extractor to capture discriminative visual characteristics from dermoscopic or skin lesion images.The extracted deep features are then fed into a machinelearning classifier to predict the skin disease category along with a confidence score. This hybrid approach reduces computational complexity while maintaining high classification performance, making the system suitable for real-time web-based deployment. To enhance transparency and trustworthiness, the system integrates Gradient-weighted Class Activation Mapping (Grad-CAM) to generate visual explanations highlighting the regions of the image that most influence the model's predictions. Beyond simple visualization, a novel Grad-CAM Reliability Score (GRS) is introduced to quantitatively evaluate the reliability of each prediction based on activation intensity and spatial distribution. This reliability score, combined with prediction confidence and probability margin analysis, enables robust decision validation. When the system detects low confidence or unreliablepredictions, it automatically classifies the outcome as "Uncertain" and

recommends medical consultation instead of providing a potentially misleading diagnosis. This reliability- aware decision mechanism significantly reduces the risk of false predictions and improves clinical safety. Additionally, the system provides severity estimation, precautionary guidance, and a user-friendly web interface to enhance accessibility. Experimental evaluation using benchmark skin disease datasets demonstrates that the proposed system achieves competitive classification accuracy while offering superior explainability and reliability assessment compared to traditional deep learning approaches. The integration of explainable AI with quantitative reliability validation represents a key contribution of this work. The proposed framework can serve as an effective decision-support tool for preliminary skin disease screening and future clinical AI systems. Keywords--This work focuses on skin disease classification using deep learning techniques with an emphasis on explainable artificial intelligence (XAI). A lightweight MobileNetV2-based feature extractor is employed along with Grad-CAM to provide visual explanations for predictions. To enhance clinical trust, a novel Grad-CAM Reliability Score (GRS) is introduced for assessing prediction reliability and handling uncertain cases effectively.

A Hybrid AI-Based Approach for Real-Time Phishing URL Detection

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ABSTRACT

Phishing attacks using deceptive URLs remain one of the most serious cybersecurity threats, exploiting user trust and continuously evolving attack strategies. Traditional phishing detection techniques, such as blacklist-based and rule-based methods, are ineffective against newly generated and zero-day phishing URLs due to their reliance on previously known patterns. Although machine learning and deep learning approaches have improved phishing detection accuracy, many existing systems suffer from limited adaptability and high false positive rates when facing emerging phishing techniques. To address these challenges, this paper proposes an enhanced hybrid AI-based framework for real-time phishing URL detection. The proposed system integrates structural URL feature analysis with contextual deep learning representations to capture both lexical characteristics and hidden semantic patterns in URLs. An ensemble learning approach is employed to improve classification robustness and accuracy, while an anomaly detection mechanism is incorporated to identify previously unseen phishing URLs. The framework also supports periodic model retraining to adapt to evolving phishing strategies. The proposed system is implemented as a web-based real-time detection platform and evaluated using publicly available phishing URL datasets. Experimental results demonstrate improved detection accuracy, reduced false positives, and enhanced robustness compared

to conventional phishing detection approaches, highlighting the effectiveness of hybrid and adaptive intelligence for real-world cybersecurity applications.

AI- DRIVEN DDoS DETECTION AND MITIGATION IN AWS

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Abstract

Distributed Denial of Service (DDoS) attacks pose a major threat to cloud computing environments by overwhelming cloud resources and
disrupting service availability. Although cloud service providers such as Amazon Web Services (AWS) offer built-in protection mechanisms, they provide limited support for intelligent real-time traffic analysis and customized attack detection. This project presents an AI-driven framework for real-time DDoS detection and mitigation in an AWS cloud environment. The proposed system captures live network traffic from EC2 instances, extracts relevant traffic features, and applies machine learning techniques to classify traffic as normal or malicious. The detected attack traffic is mitigated using AWS-native services such as security groups, auto scaling, and traffic filtering mechanisms. Experimental evaluation demonstrates improved detection accuracy with reduced false positives compared to traditional threshold-based approaches.The proposed framework enhances cloud security by combining real-time traffic monitoring with intelligent analysis while maintaining scalability and cost efficiency in AWS infrastructure.

Keywords: DDoS Attacks, Cloud Computing, Amazon Web Services (AWS), Real-Time Traffic Analysis, Intrusion Detection, Machine Learning, Cloud Security, DDoS Mitigation

Real-Time Student Monitoring System for Computer Laboratories using Computer Vision and Web-Based ERP

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Abstract

Computer laboratory sessions are essential for practical learning among technology students. However, due to manual monitoring practices in laboratories, attendance records often fail to accurately reflect students' actual work and the effective time spent during lab sessions. To alidate staff who regularly use and supervise computer laboratories. The survey results revealed that a significant percentage of students reported experiencing distraction during lab periods, while a considerable proportion of staff indicated difficulties in continuously monitoring all students. These challenges negatively impact student productivity and learning habits, leading to abnormal activities such as mobile phone usage, talking, idle sitting, and leaving seats without supervision. To address these issues, this work proposed an automated laboratory monitoring solution that integrates overhead CCTV cameras and front-facing webcams installed in the laboratory environment. Overhead cameras are used to track student actions and seating behavior, while front-facing webcams are utilized to extract facial features and analyze emotional states. The proposed system records the duration of eachdetected activity using computer vision techniques. The processed data is then analyzed and presented as detailed reports through a web-based ERP platform accessible to students, staff, and departmental authorities.

Keywords: Student Behavior Analysis, CCTV Surveillance, Educational Surveillance,Automated Lab Monitoring

Smart Heart Disease Prediction and Prevention System Using Machine Learning

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Abstract

Early identification of heart disease is vital for reducing health risks and improvingpatient survival rates. This study develops a machine learning–driven prediction model that utilises medical and lifestyle parameters to assess the likelihood of cardiovascular disease. The collected dataset undergoes systematic preprocessing to address missing values, normalise attributes, and remove irrelevant features in order to enhance model reliability. Multiple classification algorithms, including Logistic Regression, Decision Tree, Naïve Bayes, K-Nearest Neighbours, Random Forest, and Support Vector Machine, are implemented and evaluated using standard performance measures. Comparative analysis reveals that the Support Vector Machine model provides the most consistent and accurate predictions, particularly when dealing with complex clinical data patterns. The results emphasise the influence of critical risk factors such as age, blood pressure, cholesterol levels, and body mass index. The proposed

approach demonstrates the effectiveness of machine learning techniques in aiding early diagnosis and supporting data-driven clinical decision-making in cardiovascular healthcare.

Keywords: Heart Disease Prediction, Machine Learning, Support Vector Machine, Clinical Data, Risk Assessment

HYBRID AI-BASED REAL-TIME FRAUD DETECTION SYSTEM

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ABSTRACT

Financial fraud has become increasingly sophisticated with the growth of digital transactions, making traditional single- layer detection techniques insufficient. This project presents a Hybrid AI-Based Real- Time Fraud Detection System that combines rule-based logic, behavioral profiling, supervised machine learning, and unsupervised anomaly detection to identify fraudulent transactions with high accuracy and low latency. The system processes transaction data in real time through a FastAPI microservice, where deterministic rules first evaluate high-risk indicators such as transaction value, velocity spikes, and geographic inconsistencies. Behavioral analysis then examines deviations from a user's historical patterns, including time of transaction, device usage, merchant type, and location. A dynamic weight adjustment mechanism is employed to adaptively combine the outputs of all detection modules based on their performance and contextual relevance. This hybrid risk aggregation approach enables the system to respond effectively to evolving fraud scenarios. The system is implemented using a scalable and modular architecture suitable for real time environments, with efficient data preprocessing, low latency model inference, and secure data handling mechanisms. These features are further analyzed using a supervised Random Forest classifier trained on labeled transaction data and an Isolation Forest model for detecting previously unseen anomalies. Experimental evaluation usingsimulated financial transaction datasets demonstrates that the proposed hybrid system achieves higher detection accuracy, improved recall, and significantly reduced false positive rates compared to traditional rule based and single model machine learning approaches. The results confirm that combining multiple artificial intelligence techniques enhances robustness, adaptability, and real world applicability. The proposed system provides a practical and extensible solution for modern financial institutions seeking reliable, real time fraud detection while maintaining customer trust globally. To enhance adaptability, the system dynamically adjusts the weighting between supervised and unsupervised models based on recent fraud detection outcomes, enabling

improved detection of emerging fraud patterns. A web-based monitoring console visualizes live transactions, fraud scores, decisions, and processing latency, providing explainable audit details for each decision. The system achieves sub-100 millisecond response times, making it suitable for real-time deployment scenarios. This hybrid approach improves detection robustness, reduces false positives, and offers transparency in decision-making,demonstrating an effective and scalable solution for modern financial fraud prevention systems.

KeyWords: Hybrid Artificial Intelligence, Financial Fraud Detection, Behavioral Analytics, Anomaly Detection, Adaptive Machine Learning, Real-Time Transaction Monitoring.

LI - FI Technology

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Abstract

Li-Fi, or Light Fidelity, is a wireless communication technology that uses light to transmit data. It is a form of visible light communication (VLC) that utilizes light-emitting diodes (LEDs) to transmit data at high speeds. The concept of Li-Fi was first introduced by Professor Harald Haas in 2011, and since then, it has gained significant attention for its potential to revolutionize wireless communication. Li-Fi technology works by using LED lights to transmit data. The LEDs are modulated at high speeds to encode data onto the light signal. The data is then received by a photodetector, which converts the light signal back into an electrical signal. The process is similar to how infrared remote controls work, but Li-Fi operates at much higher speeds and can transmit data over longer distances. Li-Fi can achieve speeds of up to 224 Gbps, making it much faster than traditional Wi-Fi. Li-Fi has several advantages over traditional Wi-Fi. One of the main benefits is its security. Since light signals are harder to intercept than radio waves, Li-Fi is more secure than Wi-Fi. Additionally, Li-Fi can be used in areas where RF interference is a concern, such as hospitals, aircraft, and industrial settings. Li-Fi is also more energy-efficient than Wi- Fi, as it uses LED lights, which are already energy-efficient. Li-Fi has a range of potential applications. It can be used to provide high-speed internet connectivity in areas where traditional Wi-Fi is not feasible, such as underwater or in tunnels. Li-Fi can also be used for indoor navigation, as the light signals can be used to determine the location of devices. Additionally, Li-Fi can be used for IoT applications, such as smart lighting systems and smart homes. Despite its advantages, Li-Fi still faces several challenges before it can be widely adopted. One of the main challenges is the need for line-of-sight between the LED light and the receiver. Additionally, Li-Fi signals can be disrupted by obstacles, such as furniture or people. However, researchers are working on developing new technologies to overcome these challenges, and Li-Fi is expected to become a key player in the future of wireless communication.

HEALTH APPOINTMENT BOOKING SYSTEM WITH LIVE QUEUE

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ABSTRACT

Outpatient departments across healthcare institutions continue encounter persistent challenges in appointment scheduling, patient overcrowding, and excessive waiting times. Conventional paper-based or semi- digital systems offer limited real-time visibility into queue dynamics and consultation progress, contributing to operational inefficiencies, patient dissatisfaction, and suboptimal utilization of clinical resources. address these shortcomings, this study presents a web-based health appointment booking system integrated with live queue tracking and automated notification capabilities. The system enables patients to browse physicianprofiles, check real-time slot availability, and schedule consultations via an intuitive web interface. Upon confirmation, a unique digital token is issued, placing the patient into a dynamically managed virtual queue. A distinguishing feature of the system is real-time queue visualization, which allows patients to remotely monitor their position, estimated waiting time, and ongoing consultation progress without the need for physical presence in the waiting area. In parallel, the system provides healthcare administrators with operational dashboards to efficiently manage appointments, oversee patient flow, and adapt schedules in response to unforeseen disruptions. Automated notifications inform patients of queue status changes, delays, or provider unavailability, thereby enhancing transparency and reducing uncertainty. The system architecture is designed for scalability, security, and adaptability across a range of healthcare settings—from small clinics to large hospital networks. Preliminary evaluation through simulation and workflow modeling suggests a notable reduction in average patient waiting times and enhanced patient satisfaction compared to legacy queue management approaches. These findings highlight the potential of digital transformation in appointment and queue management to significantly improve service delivery, patient engagement, and operational efficiency in contemporary healthcare environments.

Keywords: Health Appointment System, Live Queue Tracking, Web-Based
Healthcare Application, Patient Waiting Time Reduction, Digital Queue

Management, Automated Notifications, Hospital Workflow

Optimization.

CRYPTO GEEKS: CRYPTO EDUCATION AND RESEARCH PLATFORM WITH PREDICTIVE SENTIMENT–PRICE MODELLING

AND EXPLAINABLE AI

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ABSTRACT

Crypto currency markets are highly volatile and exhibit rapid price fluctuations influenced by both numerical market indicators and investor sentiment expressed across digital platforms. While most existing studies focus on coarse-grained or single-horizon forecasting, there remains a lack of integrated frameworks capable of delivering reliable multi-horizon predictions for real-time decision-making. To address this gap, this paper proposes Crypto Geeks, a sentiment-aware and explainable framework for 15-minute and 1-hour crypto currency price prediction using a hybrid combination of Natural Language Processing (NLP), machine learning, deep learning, and Explainable Artificial Intelligence (XAI). The proposed system follows an end-to-end pipeline wherein real-time and historical textual data are collected from social media platforms, online news sources, and discussion forums, while high- frequency market data—comprising open, high, low, close prices and trading volume—are obtained at 15-minute resolution from reliable crypto currency market APIs. Textual data are preprocessed through noise removal, tokenization, stop-word elimination, and lemmatization, whereas numerical market data are cleaned, normalized, and temporally aligned with corresponding sentiment intervals. Sentiment polarity scores are extracted using NLP-based sentiment classification techniques and aggregated within fixed time windows. These sentiment features are fused with short-term technical indicators, including moving averages, momentum indicators, and volatility measures, to construct a hybrid feature set. Machine learning models such as Linear Regression and Random Forest, along with a Long Short-Term Memory (LSTM) network optimized for high-frequency time-series data, are trained to predict price movements for the next 15-minute and 1-hour intervals. Experimental results demonstrate that sentiment-augmented models consistently outperform traditional price-only baselines. The LSTM model achieves a directional prediction accuracy of 71.8% for 15-minute forecasts and 74.3% for 1-hour forecasts, with corresponding MAE values of 0.0029 and 0.0041,respectively. To enhance transparency, SHAP-based Explainable AI techniques are employed to interpret model predictions and quantify the relative influence of sentiment and market features. The results confirm that integrating short-term sentiment information significantly improves multi-horizon crypto currency price prediction, making the Crypto Geeks framework a scalable, interpretable,,and practical decision-support system for intraday trading and real-time market analysis.

KEYWORDS

Crypto currency Price Prediction, 15-Minute Forecasting, 1-Hour Forecasting, High-Frequency Time Series, Sentiment Analysis, Natural Language Processing, LSTM, MachineLearning, Explainable Artificial Intelligence, SHAP, Intraday Trading

FAKE NEWS DETECTION WITH SENTIMENT ANALYSIS

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Abstract

Social networking platforms have become major sources for accessing and sharing news due to their low cost, ease of use, and widespread availability; however, this convenience has also enabled the rapid spread of fake news, defined as intentionally fabricated or misleading information that can adversely impact society. The propagation of such misinformation resembles the behaviour of a contagious phenomenon, making effective detection essential. Although numerous fake news detection techniques have been proposed, most existing approaches rely solely on either textual content analysis or social context features, failing to capture the interaction between news semantics and dissemination patterns, which limits their overall effectiveness. To address this limitation, this work proposes a Lexicon-Enhanced Long Short-Term Memory (LSTM) model integrated with Natural Language Processing (NLP) techniques to improve fake news detection accuracy. The proposed framework incorporates entiment analysis using a sentiment lexicon to enrich textual representations by pre-training a sentiment-based word classifier and generating sentiment embeddings that enhance word representations, including those not present in the lexicon. By fusing sentiment embeddings with conventional word embeddings, the model achieves improved semantic understanding, enabling more accurate identification of fake news as well as unreliable users and posts. The proposed framework aims to provide a reliable mechanism for evaluating the credibility of news sources and maintaining the quality of information shared across social media platforms, offering a robust and efficient solution to combat the growing challenge of misinformat

ART OF SPENDING A SMART EXPENSE TRACKING AND SYSTEM Deeraj S

S,AlmuzzssamfurkhanM,Aathifa Anjum A
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ABSTRACT

Due to disjointed expense tracking, low spending awareness, and inadequate decision-support in current systems, managing finances both personally and professionally is still difficult. With little automation and little behavioral insight, the majority of traditional expense management programs rely on manual data entry and static reporting. The smart expense tracking system ART OF SPENDING, which aims to integrate personal and professional financial workflows on a single

platform, is presented in this paper. Dual operating modes with personalized expense categories, reporting structures, and workflow controls are supported by the system. Expenses can be recorded manually or automatically using voice-based input and SMS parsing. Continuous use with dependable data synchronization upon network availability is guaranteed by an offline-first architecture. The proposed system integrates an AI-driven intelligence layer for enhanced financial insight. This includes spending behavior classification, adaptive budget adjustment based on historical data, ethical spending indicators, and decision impact analysis for hypothetical expenses. Predictive features such as expense recall and future expense projection assist users in proactive financial planning. For professional environments, the system incorporates approval hierarchies, role-based access control, and risk assessment mechanisms to support organizational expense governance. Visual dashboards, automated alerts, and structured financial reports improve transparency and decision-making. The system architecture is modular, scalable, and secure, making it suitable for individual users and small to medium-scale organizations.

Keywords: Smart Expense Tracking, Financial Intelligence System, AutomatedExpense Management, Budget Optimization, Spending Behavior Analysis, Offline-First Application, AI-Driven Financial Insights, Expense Governance.

Intrusion detection System using Machine Learning

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ABSTRACT

The use of computers and the internet has spread rapidly over the course of the past few decades. Every day, more and more people are coming to rely heavily on the internet. When it comes to the field of information security, the subject of security is one that is becoming an increasingly important focus. It is vital to design a powerful intrusion detection system in order to prevent computer hackers and other intruders from effectively getting into computer networks or systems. This can be accomplished by: (IDS). The danger and attack detection capabilities of the computer system are built into the intrusion detection system.Abuse has occurred and can be used to identify invasions when there is a deviation between a preset pattern of intrusion and an observed pattern of intrusion. An intrusion detection system (IDS) is a piece of hardware (or software) that is used to generate reports for a Management Station as well as monitor network and/or system activities for unethical behaviour or policy violations. In the current study, an approach known as machine learning is suggested as a possible paradigm for the development of a network intrusion detection system. The resultsof the experiment show that the strategy that was suggested improves the capability of intrusion detection.

ML - DRIVEN PREDICTIVE ANALYSIS FOR HEART DISEASE DIAGNOSIS

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ABSTRACT

Heart disease remains a preeminent global health challenge, accounting for approximately 17.9 million deaths annually. Conventional diagnostic approaches often rely on manual clinical assessments that are time-consuming and prone to human error. This paper presents a robust, web-based heart disease prediction system that leverages machine learning to provide accurate, data-driven diagnostic support. To address the limitations of existing models which often suffer from demographic bias and restricted clinical focus this system integrates diverse datasets and extended patient attributes, including clinical markers and lifestyle-related factors such as smoking and physical activity. The proposed framework achieves enhanced predictive performance by integrating a suite of advanced algorithms, including Light Gradient Boosting Machine (LightGBM), Deep Neural Networks (DNN), Multilayer Perceptron (MLP), K- Nearest Neighbors (KNN), and Naive Bayes. To ensure high data quality and model reliability, a comprehensive preprocessing pipeline is implemented, involving outlier removal, feature engineering, and K-modes clustering for categorical variables. Performance is validated using standard metrics such as accuracy, precision, recall, and F1-score. Furthermore, to mitigate the "black-box" nature of traditional AI and foster clinical trust, the system incorporates Explainable Artificial Intelligence (XAI) through SHAP (Shapley Additive explanations) analysis. This provides healthcare professionals with transparent, feature-level insights into how risk factors contribute to each classification. The system is deployed via a user-friendly Flask-based web interface integrated with an SQLite database, enabling secure, real-time risk assessment and clinical decision support. Experimental results demonstrate a prediction accuracy exceeding 90%, confirming the system's effectiveness in supporting early intervention strategies and improving cardiovascular patient outcomes on a global scale.

KEYWORDS

Heart Disease Prediction, Machine Learning, LightGBM, Deep Neural Networks (DNN), Multilayer Perceptron (MLP), Explainable AI (XAI), SHAP Analysis, K-modes Clustering, Feature Engineering, Data Preprocessing. Flask- based Web Interface, SQLite Database,

MeterGuard: Multi-Class Electricity Theft Detection and Proactive Countermeasures for Smart-Home Energy Systems

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ABSTRACT

Electricity theft in smart-home energy systems has become a serious challenge due to the increasing use of advanced metering infrastructure and digital communication networks. Consumers may manipulate smart meters, communication channels, or stored meter data to reduce electricity bills, resulting in significant revenue loss for utilities, inaccurate billing, and reduced grid reliability. Existing electricity theft detection techniques are often limited to rule- based methods or single-attack detection models and fail to handle complex scenarios where physical, cyber, and data-level attacks occur simultaneously. In addition, weak communication security in many systems allows attackers to intercept, alter, or replay meter readings. To address these challenges, this project proposes MeterGuard, an integrated and intelligent electricity theft detection framework for smart homes. The system employs a single XGBoost-based multi-class classification model to detect abnormal consumption behavior and classify theft incidents into Physical, Cyber, and Data attacks. Smart-meter readings, tamper alerts, communication logs, and feeder-level comparisons are combined to generate meaningful features that improve detection accuracy while reducing false alarms. Furthermore, to prevent manipulation of meter data during transmission, the system use AES-256-GCM authenticated encryption, ensuring confidentiality, integrity, and protection against spoofing and replay attacks. The proposed framework provides unified theft detection, accurate attack classification, and secure data transmission within a single system. Experimental validation using realistic consumption patterns and simulated theft scenarios demonstrates improved detection

performance, enhanced billing accuracy, and increased reliability of smart-home energy systems. As a result, MeterGuard offers a practical and scalable solution for utilities to reduce non-technical losses and strengthen smart-grid security.

KEYWORDS

Electricity Theft Detection, Smart Homes, Smart Metering, XGBoost Classifier, Multi-Class Classification, Non-Technical Loss, Secure Communication, AES-256-GCM, Anomaly Detection, Smart Grid Security

AI-based Web Automation Agent

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Abstract :

Traditional web automation systems always struggle with unseen website structures, dynamic layouts, with static selectors of the website also due to vague user inputs takes lots of time for web surfing according to the user input. Both rule-based and LLM-driven methods mostly fail to adapt to real time errors or unexpected errors, and struggle to generate with heterogeneous web environments.

To solve this, this research introduces an AI-based Web Automation Agent for Autonomous Website Interaction, a multi-agent framework capable of interpreting natural language instructions as prompt and autonomously performing web tasks without prior domain-specific training. The proposed architecture integrates Playwright’s automation framework with Large Language Models (LLMs) to build a self- correcting, adaptive system. It is structured into four layers: (1) a User Interaction Layer that allows minimal user input and applies prompt optimization mechanisms to generate structured, ready instructions for the system.(2) a Reasoning Layer using LLMs for understanding and decomposition of task ; (3) an Execution Layer leveraging Playwright for dynamic, real-time automation also included with built-in mechanisms like detection of visual-diff, monitoring of DOM mutation, also include with recovery of adaptive selector; and (4) The Multi-Modal Context Fusion Layer performs weighted integration of visual perception (80%) and DOM-derived structural and semantic cues (20%) to

construct a unified representation of the web interface. By aggregating screenshots, accessibility trees, and console logs, it maintains situational awareness under dynamic layout changes and runtime execution errors With a hybrid symbolic-neural learning approach and generalization , the system can perform consistently across multiple domains, including e-commerce, government, and social platforms. Ultimately, this research proposes an automation paradigm that bridges deterministic scripting with adaptive, intelligent web interaction—making automation more accessible, reliable, and human-centered, ready instructions for the system.

Recruitment simplification in GCCs using mern stack

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ABSTRACT

Recruitment simplification in Global Capability Centers (GCCs) is essential due to high applicant volumes and complex hiring workflows.This project proposes a web-based recruitment automation platform developed using the MERN stack (MongoDB, Express.js, React.js, Node.js). The system streamlines the entire hiring process by automating resume screening, candidate shortlisting, interview scheduling, and status tracking. Natural Language Processing (NLP) techniques are used to analyze resumes and match candidate skills with job requirements, reducing manual effort and bias. Recruiters gain a centralized dashboard for efficient decision-making, while candidates experience faster responses and transparency. The platform improves hiring efficiency, accuracy, and overall

recruitment experience in GCC environments. The system supports role-based access for HR personnel and interviewers, ensuring secure data handling and workflow control. By leveraging scalable web technologies, the platform can handle large recruitment demands typical of GCCs and can be enhanced in the future with AI-driven analytics and intelligent hiring recommendations.

Smart Systems & Decision Sciences: Contemporary Trends in Operational Research.

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ABSTRACT

Smart Systems integrated with Decision Sciences are redefining the scope of Operational Research (OR) in the ~~era of digital transformation. Traditional OR models~~, though effective in structured environments, often struggle with real-time data, system complexity, and dynamic decision contexts. This review paper examines contemporary trends that bridge classical O techniques with intelligent technologies such as Artificial Intelligence Machine Learning, Big Data Analytics, Internet of Things, and Digital Twins. The study aims to explore how these smart technologies enhance predictive, prescriptive, and adaptive decision-making capabilities. Key objectives include analyzing the evolution of intelligent OR models, identifying sectoral applications, and highlighting methodological innovations like hybrid optimization–AIframeworks and real-time decision support systems. The purpose is to provide a conceptual understanding of how smart, data-driven systems improve operational efficiency, resilience, and accuracy. Review findings indicate a shift toward autonomous, scalable, and data-centric decision models, while also emphasizing challenges related to data security, system integration, and model interpretability, suggesting directions for future research.

KEYWORDS : Smart Systems, Decision Sciences, Operational Research, Intelligent Decision-Making

Retinal Fundus-Based Automated Screening for Early Cardio vascular Disease Risk Detection

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Abstract

Cardiovascular disease remains the world's most significant health challenge, largely because it is often detected only after a major cardiac event has already occurred. This research addresses the problem by utilizing the retina as a natural "window" into the heart, as the microvascular structures in

the eye closely mirror the condition of the body's overall circulatory system. An automated screening framework is proposed using the EfficientNet-B0 deep learning architecture, which is specifically designed to be lightweight while maintaining high classification accuracy. By employing transfer learning, the model is capable of identifying subtle retinal microvascular changes—such as vessel thinning and abnormal branching patterns—that are imperceptible to the human eye but strongly associated with early-stage cardiovascular disease. To enhance clinical trust and transparency, Grad-CAM explainability is integrated into the framework. This technique generates visual heatmaps that highlight the specific retinal regions influencing the model's predictions, enabling clinicians to interpret and validate the AI-driven decisions rather than treating the system as a "black box." The proposed approach achieved an accuracy of 91.2% in classifying individuals into low, moderate, and high cardiovascular risk categories. As the method is entirely non-invasive, does not require needles, and avoids expensive specialized equipment, it provides a rapid and cost-effective solution suitable for large-scale screening. This makes it particularly valuable for early detection of heart disease in diverse clinical and resource-limited settings, allowing timely intervention during the most treatable stages of the condition.

Keywords — Machine Learning, Retinal Fundus Analysis, Cardiovascular Disease, Early Risk Detection, Deep Learning, EfficientNet, Grad-CAM.

GRABEZ – A VISUAL FLOW-BASED BUILDER FOR INTELLIGENT SYSTEMS AND LEARNING PIPELINES

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ABSTRACT

In today's world, nobody has the time to hard-code. Making use of AI assistants and tools to complete our code, projects and tasks is the reality of today's tech world. Enabling the construction of algorithms, models for learning and applications without having to write programs from scratch. Agents, chat bots, models etc., are made with simply dragging the blocks and connecting them to each other; and you can even see their code and change it and download the wireframe or use as a template for your own project. Play around a playground build with React Flowand add drop different blocks of code to build AI & ML apps like building a house with steps. The key purpose of the project to create a simple tool for students and researchers to learn with ease about flow of models,

algorithms and applications technically and visually. It also supports advanced tasks which involve AI, ML, deep learning, pipelines and etc., providing multi-platform usability.

Keywords: AI and ML, ReactFlow, learn visually, Vibe Coding, drag and drop, deep learning pipeline

AI- Powered Phishing Detection : Securing Web Navigation with MachineLearning

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ABSTRACT

With the rapid growth of internet usage and digital services, web-based cyber threats have increased significantly, with phishing attacks emerging as one of the most common and dangerous forms of cybercrime. Phishing involves the creation of fake websites or malicious links that closely resemblelegitimate platforms to deceive users into revealing sensitive information such as usernames, passwords, banking credentials, and personal data. Traditional phishing detection approaches, including blacklistbased and rule-based systems, are often ineffective against newly generated phishing websites, as attackers continuously evolve their techniques to bypass existing security measures. To overcome these limitations, this project focuses on AI-Powered Phishing Detection to secure web navigation using Machine Learning techniques. The proposed system analyzes website characteristics and user interaction patterns in real time by training supervised machine learning models on large datasets containing both legitimate and phishing URLs. Important features such as URL length, presence of suspicious characters, domain age, SSL certificate status, redirection behavior, and webpage content structure are extracted for accurate classification. Algorithms such as Logistic Regression, Decision Trees, Random Forest, and Support Vector Machines are employed, with ensemble models offering improved accuracy and robustness. The trained model is integrated into a browser-level or web-based security framework to analyze URLs before user interaction and generate instant alerts when maliciouswebsites are detected, thereby preventing data theft. Compared to traditional methods, this AI-poweredapproach adapts effectively to evolving phishing strategies, reduces false positives, and ensures a saferbrowsing experience. Furthermore, the system is scalable and can be enhanced using deep learning and natural language processing techniques to analyze webpage text, emails, and social media links.Overall, AI-Powered Phishing Detection using Machine Learning provides an intelligent, proactive,,and reliable defense mechanism that enhances cybersecurity awareness and protects users from financial loss and identity theft, highlighting the critical role of artificial intelligence in modern web security.

Keywords

Artificial Intelligence, Phishing Detection, Machine Learning, Cybersecurity, Web Security, URL Analysis, Malicious Websites, Online Fraud Prevention, Data Protection, Intelligent Threat Detection.

SMART DELIVERY DEVICE

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ABSTRACT

The rapid growth of e-commerce and automation-driven logistics has significantly intensified challenges associated with last-mile parcel delivery, particularly in ensuring security, traceability, and delivery authenticity. Conventional delivery systems largely depend on manual verification processes, static tracking mechanisms, and single-factor authentication, which are increasingly inadequate in addressing modern threats such as package theft, unauthorized access, misdelivery, and environmental damage during transit. To overcome these limitations, this paper presents an AI-Driven Smart Delivery Box that integrates Internet of Things (IoT) technologies, edge-based artificial intelligence, and multi-factor authentication to deliver a secure, intelligent, and autonomous parcel delivery solution. The proposed system employs a context-aware, Zero Trust security model that verifies every delivery attempt rather than assuming trust by default. Access to the delivery box is granted only when three independent authentication layers are successfully validated: (i)GPS-based geo-fencing, ensuring the box is located within a predefined delivery zone; (ii)AI-based facial recognition with liveness detection, enabling robust biometric authentication under varying environmental conditions; and (iii) One-Time Password (OTP)verification, delivered securely via GSM to the registered recipient. The system is built around a Raspberry Pi 4 as the core processing unit, integrated with a Neo-6M GPS module,SIM800L GSM module, Pi Camera, and multiple environmental and tamper-detection sensors, including vibration, magnetic, temperature, and humidity sensors. All authentication and decision-making processes are executed at the edge, reducing latency, preserving user privacy, and eliminating dependency on continuous cloud connectivity. Real- time monitoring and encrypted communication allow both senders and recipients to track parcel status, receive alerts, and verify delivery integrity throughout the logistics lifecycle. Experimental evaluation demonstrates strong system performance, achieving 98.4% overall authentication accuracy, 97.9% precision, 98.3% recall, and an average end-to-end response latency of 1.4–1.6 seconds, making the solution suitable for real-time deployment. The false positive rate for unauthorized access and tamper detection remained below 2%, indicating high reliability under real-world conditions. The results confirm that combining AI-based biometric verification, IoT-enabled

sensing, and geo-fencing within a multi-layer authentication framework significantly enhances last-mile delivery security and efficiency. The proposed Smart Delivery Box offers a scalable, tamper-resistant, and intelligent solution for modern logistics systems, smart lockers, and unmanned delivery infrastructures, paving the way for next-generation secure parcel delivery network

AI-Based Power Switching System Between Renewable Energy and Grid Power with a Real-Time Web Dashboard Using Raspberry Pi

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Abstract

The rapid growth in global electricity consumption, coupled with the need for improved energy efficiency and sustainability, has driven the evolution of smart grid technologies and intelligentenergy management solutions. This paper presents the design and implementation of an Artificial Intelligence (AI)-based Intelligent Energy Management System (IEMS) that autonomously manages and switches power sources between renewable energy (RE) systems—specifically solar photovoltaic (PV)—and the conventional utility grid. The proposed system aims to optimize energy utilization,minimize operational costs, and ensure uninterrupted power supply under varying environmental and load conditions. The IEMS employs AI-based decision-making techniques such as Fuzzy Logic Control (FLC) or Adaptive Neuro-Fuzzy Inference Systems (ANFIS) to intelligently regulate power flow. These algorithms analyze multiple real-time parameters, including solar irradiance availability, loaddemand patterns, grid tariff rates, and system power measurements, to determine the optimal source selection. By prioritizing renewable energy usage during favorable conditions and intelligentlyswitching to the grid when necessary, the system enhances energy efficiency and reduces dependency on non-renewable sources.The hardware architecture is built around a Raspberry Pi acting as the central controller, interfaced with voltage and current sensors to continuously monitor electrical parameters and calculate real-time power consumption and generation. Relay modules enable seamless switching between energy sources based on AI-driven control logic. Additionally, the system integrates Internet of Things (IoT)capabilities, enabling remote monitoring and control through a web-based dashboard developed using Flask, with cloud data visualization and analytics supported by platforms such as ThingSpeak.The proposed AI-driven IEMS demonstrates a cost-effective, scalable, and reliable solution for localized smart energy systems.

An Autonomous Research Agent for Automated Literature Review and Summarization

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Abstract:

The rapid growth of scientific publications in computational intelligence has made manual literaturereview less efficient, incomplete, and harder to reproduce, especially for new topics like large languagemodels (LLMs). This research presents an autonomous research agent that handles literature discovery,retrieval, and synthesis using computational intelligence techniques. When given a high-level naturallanguage research question, the system automatically creates several diverse search queries andretrieves candidate papers from scholarly knowledge graphs. About fifty abstracts are collected andranked by their relevance to find the most relevant studies. Selected papers are then obtained through areliable PDF acquisition process that manages partial open access and temporary download failures.The successfully retrieved documents undergo text extraction, segmentation, and indexing into a hybridvector database that combines dense embeddings with sparse keyword representations to supporteffective semantic and lexical searches. A retrieval-augmented generation framework uses this indexedcollection to create a structured, citation-supported markdown summary, with references appearing asfootnotes linked to the source documents. The agent has an orchestration layer that refines searchqueries dynamically when the retrieved context is not enough, allowing knowledge gathering tocontinue without more input from the user. Experimental testing on recent LLM-related researchquestions shows that this approach improves the coverage and relevance of retrieved literature whilesignificantly cutting down the effort needed from humans in the early stages of preparing a survey.Additionally, a comparative analysis of combined findings helps identify new trends and research gapsthat have not been fully explored. This system shows how agent-based AI and hybrid retrieval methodscan boost research productivity and reproducibility, supporting human-centered, intelligent knowledgediscovery.

Web-Based Soil Health & Fertilizer Advisory System

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Abstract:

Agriculture remains the backbone of the Indian economy, employing a significant portion of the population and contributing substantially tonational income. Despite technological advancements in other sectors, agriculture still heavily depends on traditional knowledge, intuition and experience-based decision-making. This often results in inefficient crop selection, excessive fertilizer application, poor soil management and reduced agricultural productivity. One of the most critical factors influencing crop yield is soil health, which depends on the balance of essential nutrients such as Nitrogen (N), Phosphorus (P), Potassium (K) and soil pH. However, most farmers lack access to

simplified soil analysis tools and expert agricultural guidance. This project proposes a Web-Based Soil Health & Fertilizer Advisory System designed to provide scientific, data-driven agricultural recommendations through an easy-to-use web platform. The system aims to assist farmers in selecting suitable crops based on soil nutrient composition and seasonal conditions. By analyzing soil parameters including NPK values and pH levels, the system evaluates soil fertility and determines crop suitability. Based on this analysis, it generates intelligent crop recommendations that are best suited for the given soil and season. In addition to crop selection, the system provides a comprehensive fertilizer advisory module that recommends appropriate fertilizer types and precise application quantities. This prevents over-fertilization, which is a major cause of soil degradation, water pollution, and reduced crop quality. The system further enhances decision-making by offering stage-wise crop growth guidance, covering critical phases such as seed selection, sowing, irrigation, nutrient management, pest control and harvesting. This ensures continuous farmer support throughout the crop lifecycle. The proposed system is developed as a web-based application to ensure accessibility, scalability an platform independence. Farmers can access the system using any internet-enabled device without requiring specialized hardware or software. The modular architecture of the system allows for future expansion, including integration with weather forecasting services, IoT-based soil sensors and machine learning models for yield prediction. By combining agricultural domain knowledge with modern web technologies, the system promotes precision agriculture, improves crop yield, optimizes fertilizer usage and supports sustainable farming practices. The solution reduces dependency on guesswork and expert availability, enabling farmers to make informed decisions independently. Overall, the Web-Based Soil Health & Fertilizer Advisory System contributes to increased agricultural efficiency, environmental protection and long-term soil sustainability.

Automated Detection of Diabetic Retinopathy and External Eye Diseases Using Deep Learning

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Abstract

Diabetic Retinopathy (DR) is a leading cause of vision impairment among working-age adults worldwide, and its prevalence is rapidly increasing due to the global rise in diabetes. In parallel, external eye diseases such as cataract, conjunctivitis, glaucoma, and pterygium contribute significantly to preventable blindness when early diagnosis and treatment are not available. Conventional diagnostic procedures rely heavily on manual clinical examination and expert interpretation of retinal fundus images and external eye photographs, making the screening process time-consuming, expensive, and difficult to scale in rural and resource- constrained healthcare environments. This paper presents an integrated and automated deep learning–based system for the detection and classification of both Diabetic Retinopathy and multiple external eye diseases using retinal fundus images and external eye photographs. The proposed framework is built upon a convolutional neural network (CNN) architecture capable of learning high-level discriminative features directly from raw images. Advanced preprocessing steps, including image resizing, normalization, contrast enhancement, noise reduction, and extensive data augmentation, are employed to improve image quality, reduce overfitting, and enhance robustness against variations in illumination and image acquisition conditions.This paper proposes an automated deep learning–based framework for the early detection and classification of Diabetic Retinopathy and multiple external eye diseases using ocular images. The proposed system utilizes a convolutional neural network (CNN) architecture to automatically Learning, Convolutional Neural Network, MedicaImage Processing, Automated Eye Disease Detection learn discriminative features from both retinal fundus. images and external eye photographs, eliminating the need for handcrafted feature extraction. Image preprocessing techniques such as resizing, normalization, contrast enhancement, and data augmentation are applied to improve image quality, address class imbalance, and enhance model generalization. The model is trained and evaluated on publicly available ophthalmic image datasets, enabling multi-class classification of different DR severity levels as well as various external eye conditions. Performance evaluation is conducted using standard metrics including accuracy, sensitivity, specificity, precision, recall, and F1-score. Experimental results demonstrate that the proposed deep learning model achieves superior performance compared to traditional machine learning approaches, indicating its effectiveness in accurate and reliable eye disease detection. Furthermore, the developed system is designed to be computationally efficient and suitable for deployment on low-cost embedded platforms such as Raspberry Pi, enabling real-time screening in point-of-care and tele- ophthalmology applications. The proposed approach offers a scalable, non-invasive, and cost-effective solution to assist ophthalmologists in early diagnosis and clinical decision-making, ultimately contributing to the reduction of vision loss.

AUTONOMOUS LANE KEEPING ASSISTANT SYSTEM USING IMAGE PROCESSING

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ABSTRACT

An Autonomous Lane Keeping Assistant System (ALKAS) using image processing techniques is proposed to improve road safety and minimize accidents caused by unintended lane departure. The system employs a forward-facing camera to continuously capture real-time road images, which are processed to identify lane markings such as single, double, and broken lines under varying road conditions. The acquired images are preprocessed using grayscale conversion, noise reduction, and edge detection to extract lane features accurately. Lane boundaries are then detected and the vehicle's relative position with respect to the lane center is estimated. Based on this information, appropriate steering control commands are generated to keep the vehicle aligned within the detected lane. The proposed system provides a low-cost, real-time, and reliable solution suitable for autonomous and advanced driver assistance systems (ADAS), demonstrating the effectiveness of vision-based lane keeping using image processing.

FACIAL AND VOICE RECOGNITION BASED SECURITY AND SAFETY SYSTEM IN CAR

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ABSTRACT

With the rapid growth of automobile technology, vehicle security and driver safety have become major concerns. Traditional car security systems such as mechanical keys, remote locking, and PIN-based access are increasingly vulnerable to theft and unauthorized usage. To overcome these limitations, this paper proposes a Facial and Voice Recognition Based Security and Safety System for Cars, which enhances both vehicle security and driver authentication.The proposed system uses facial recognition to identify authorized users before granting access to the vehicle. A camera installed inside or near the vehicle captures the driver's face and compares it with stored facial data using image processing and machine learning techniques. In addition, voice recognition is employed as a secondary authentication layer, allowing the system to verify the driver through predefined voice commands. This dual-authentication approach improves accuracy and reduces the risk of unauthorized access.Beyond security, the system also focuses on driver safety by monitoring driver

presence and identity continuously. If an unauthorized person attempts to operate the vehicle, the system can prevent engine ignition and trigger alerts to the owner through alarms or mobile notifications. The integration of facial and voice recognition makes the system user-friendly, contactless, and reliable.Overall, the proposed system provides a smart, secure, and efficient solution for modern vehicles, combining advanced biometric technologies to enhance protection against theft while ensuring safe vehicle operation. This approach has strong potential for future intelligent transportation systems and smart automotive applications.

LOCALIZATION AND IDENTIFICATION SYSTEM OF PERSONNEL IN RISK AREAS USING A WIRELESS SENSOR NETWORK

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ABSTRACT

Personnel operating in hazardous environments such as defense zones, underground mines, and industrial plants face severe risks due to extreme temperatures and the presence of toxic or combustible gases. Continuous monitoring and precise localization of personnel in such areas are essential to ensure safety and enable rapid emergency response. This project presents a Localization and Identification System of Personnel in Risk Areas using a Wireless Sensor Network (WSN) integrated with IoT technology. In the proposed system, each personnel is equipped with an Arduino-based wearable node integrated with a GPS module for real-time location tracking and unique identification. Environmental monitoring is achieved using temperature sensors and gas sensors to detect unsafe working conditions. These wearable nodes form a wireless sensor network that continuously collects location and environmental data. A NodeMCU (ESP8266) module functions as an IoT gateway, transmitting sensor and GPS data wirelessly to a cloud-based monitoring platform. The collected data is displayed on a web dashboard, enabling supervisors to track personnel positions and monitor environmental conditions in real time. When the temperature exceeds predefined safety limits or when abnormal gas concentrations are detected, the system automatically triggers instant alerts to the IoT platform. These alerts assist authorities in taking immediate corrective actions such as evacuation, ventilation activation, or rescue deployment. The proposed system offers a reliable, low-cost, and scalable safety solution suitable for large- scale deployment in mining, defense, and industrial sectors. By integrating Arduino, GPS, gas and temperature sensors, NodeMCU, Wireless Sensor Networks, and IoT, the system enhances worker safety, situational awareness, and emergency management, thereby significantly reducing risks associated with hazardous working environments.

VEHICLE ACCIDENT DETECTION AND PREVENTION SYSTEM USING GPS AND GSM

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ABSTRACT

This project focuses on the design and development of a vehicle accident detection and prevention system aimed at improving road safety and reducing fatal consequences during road accidents. With the increasing number of vehicles and traffic density, accidents caused by driver fatigue, over-speeding, and delayed emergency response have become a serious concern. The proposed system addresses these issues through real-time monitoring, detection, and alert mechanisms. The system uses sensors such as accelerometers, vibration sensors, ultrasonic sensors, and GPS modules interfaced with a microcontroller to continuously monitor vehicle conditions. Sudden impact, abnormal tilt, or rapid deceleration is detected to identify accident situations. Upon detection, the system automatically sends alert messages along with the vehicle's live location to emergency contacts or rescue services, ensuring quick response and assistance. In addition to accident detection, the system also incorporates preventive features such as obstacle detection, speed monitoring, and driver alert mechanisms to minimize the chances of collisions. Alerts are provided to warn the driver during critical situations. This project offers a reliable, cost-effective, and efficient solution for accident detection, prevention, and rapid emergency response, making it suitable for modern intelligent transportation systems.

Real Time Heart Rate Monitoring System

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ABSTRACT

Heart rate monitoring systems are critical in modern healthcare, enabling continuous tracking of cardiovascular health. Traditional cloud-based solutions pose privacy risks due to centralized data storage and transmission vulnerabilities. To address these concerns, integrating homomorphic encryption with edge computing offers a secure and efficient framework for real-time heart rate monitoring. Cardiovascular diseases (CVDs) remain a leading cause of mortality worldwide. Wearable devices and IoT-based health monitoring systems provide continuous heart rate tracking, but data security and latency issues hinder widespread adoption. Heartbeat Sensor is an electronic device that is used to measure the heart rate i.e. speed of the heartbeat. Monitoring body temperature, heart rate and blood pressure are the basic things that we do in order to keep us healthy. In order to measure the body temperature, we use thermometers and a sphygmomanometer to monitor the Arterial Pressure or Blood Pressure. Heart Rate can be monitored in two ways: one way is to

manually check the pulse either at wrists or neck and the other way is to use a Heartbeat Sensor. Pulse oximetry is used in this project to detect the heartbeat using fingers. When the heart expands (diastole) the volume of blood inside the fingertip increases and when the heart contracts (systole) the volume of blood inside the fingertip decreases. The resultant pulsing of blood volume inside the fingertip is directly proportional to the heart rate and if you could somehow count the number of pulses in one minute, that's the hear rate in beats per minute (bpm). For this an IR transmitter/receiver pair (LED) placed in close contact with the fingertip. When the heart beats, the volume of blood cells under the sensor increases and this reflects more IR waves to sensor and when there is no beat the intensity of the reflected beam decreases.

Machine Learning–Based Framework for Multi-Disease Risk Level Assessment

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ABSTRACT

Machine learning has gained significant importance in the healthcare domain due to its capability to analyze large medical datasets and assist in early disease risk assessment. Chronic diseases such as diabetes, heart disease, and Parkinson's disease continue to increase globally, often remaining undetected during their early stages. Traditional diagnostic approaches rely on clinical tests and expert consultation, which may be time-consuming, costly, and not always accessible. Most existing machine learning-based healthcare systems focus on predicting or assessing the risk of a single disease. This results in fragmented healthcare solutions where users must depend on multiple independent systems to evaluate different diseases. Such an approach reduces usability and limits comprehensive health assessment. This paper proposes a Machine Learning–Based Framework for Multi-Disease Risk Level Assessment, designed to provide a unified solution for predicting the risk levels of multiple diseases through a single platform. The framework integrates individual prediction models for diabetes, heart disease, and Parkinson's disease using standard healthcare datasets.

Key features of the proposed framework include: Integration of multiple disease prediction models into a unified system Use of supervised machine learning algorithms for disease-specific prediction Assessment of disease risk levels rather than simple binary outcomes Modular and scalable design to support future disease inclusion The system processes user-provided medical parameters through data preprocessing and feature analysis to generate disease-specific risk predictions. Experimental evaluation using publicly available datasets demonstrates reliable prediction performance across different disease categories. The proposed framework is intended as a supportive and preventive healthcare tool, not as a replacement for professional medical diagnosis. By enabling early multi-

disease risk assessment through a single system, the framework aims to improve accessibility, efficiency, and decision support in healthcare applications.

FLOW STABILIZATION STRATEGIES IN SUPERSONIC SCRAMJET COMBUSTORS: A REVIEW OF SEMI-AEROFOIL STRUCTURES AND FLOW SPLITTERS"

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ABSTRACT

The scramjet engine takes large amount of air to run the engine. In this the flow of air is turbulent in combustor part that the velocity of air will be in that area due to high velocity of air the pressure will be increased in combustor. That leads to the destruction of combustor. To maintain the steady and non-turbulent flow that we introduced semi-aerofoil structures near the inlet point by doing this semi-aerofoil structures which will provide less friction inlet and it compresses the air that flows through high velocity to the later section of the system is in rectangular shape by doing this it will maintains steady flow of air that reaches the specimen area. In this specimen area we have attached a specimen called as tob-shaped object which is placed at quator distance before the exit that which divides the flow by splitting it. By the semi- aerofoil and tob helps to maintain steady flow in the combustor and to avoid swirls that which will develop the pressure towards maintain structure of combustor. By placing the objects there is steady flow in the combustor.

Intelligent MRI-Based Neuro Cognitive Stage Classification System

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ABSTRACT

Alzheimer's disease is a slow process that affects the memory and cognitive skills of a person, and it mainly occurs in older people. As Alzheimer's disease worsens with time, it is important to detect the disease as early as possible to make a significant impact in the treatment and care of the patient. In this project, we developed a deep learning model that can classify various stages of Alzheimer's disease from brain MRI images. The dataset consisted of four categories of images: Non-Demented, Very Mild, Mild, and Moderate Demented. Prior to training the model, the images were preprocessed to enhance their quality and diversity. The model that we employed is a small four-

layer CNN that was capable of learning key features from the MRI images without being too complex and heavy. The model was trained using the conventional method of dividing the dataset into training, validation, and testing sets. Once the model was trained, it was able to achieve a test accuracy of 99.07% , indicating that the model is capable of classifying unseen MRI images with a high level of confidence. A heatmap visualization was also incorporated to make the regions affected in the brain easier to understand. Finally, a simple web interface was developed to enable the uploading and processing of MRI images directly. Based on the results, the system has evident potential as a useful tool in assisting doctors with early Alzheimer detection and stage classification.

Keywords

Alzheimer's disease, brain MRI, custom CNN model, deep learning, medical image classification, automated diagnosis, neurodegenerative disorder, multi-class prediction, computer-aided diagnosis, early detection

Recruitment simplification in GCCs using mern stack

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ABSTRACT

Recruitment simplification in Global Capability Centers (GCCs) is essential due to high applicant volumes and complex hiring workflows. This project proposes a web-based recruitment automation platform developed using the MERN stack (MongoDB, Express.js, React.js, Node.js). The system streamlines the entire hiring process by automating resume screening, candidate shortlisting, interview scheduling, and status tracking. Natural Language Processing (NLP) techniques are used to analyze resumes and match candidate skills with job requirements, reducing manual effort and bias. Recruiters gain a centralized dashboard for efficient decision-making, while candidates experience faster responses and transparency. The platform improves hiring efficiency, accuracy, and overall recruitment experience in GCC environments. The system supports role-based access for HR personnel and interviewers, ensuring secure data handling and workflow control. By leveraging scalable web technologies, the platform can handle large recruitment demands typical of GCCs and can be enhanced in the future with AI-driven analytics and intelligent hiring recommendations.

Hybrid Piezoelectric and Solar Energy Harvesting from Roadways

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ABSTRACT

Piezoelectric energy harvesting from roadways provides a sustainable approach to utilize the mechanical energy generated by vehicular movement under open-traffic conditions. This paper presents an analytical and optimization study of pavement-embedded piezoelectric transducers subjected to dynamic and non-uniform traffic loads. A scaling law–based method is applied to evaluate energy output across different harvester sizes and traffic intensities. The proposed approach enables efficient performance prediction while reducing design complexity. Results indicate that optimized scaling improves power generation without affecting roadway structural integrity. This study highlights the potential of scalable piezoelectric systems for powering smart transportation and monitoring applications.

IOT-BASED WILD ANIMAL DETECTION AND ALERT SYSTEM FOR ROAD SAFETY AND FARMLAND PROTECTION

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ABSTRACT

Human–wildlife conflict has increased significantly due to rapid urbanization and deforestation, resulting in frequent wild animal intrusions into roads and farmlands. These intrusions lead to road accidents, crop damage, and threats to both human life and wildlife. To address this issue, this project proposes an IoT-Based Wild Animal Detection and Alert System for Road Safety and Farmland Protection, integrating image processing for intelligent and selective animal detection.The proposed system uses PIR sensors to detect motion and camera modules to capture images of the intruding animals. Image processing techniques using OpenCV are employed to analyze the captured images and identify specific animal types based on size and features. Based on this analysis, animals are classified into high-risk and low- risk categories. Alert and deterrent mechanisms are activated only when high- risk animals such as elephants are detected, while alerts are suppressed for small, non-threatening animals like rats, thereby reducing false alarms.An Arduino-based controller handles sensor interfacing, control logic, and communication. A GSM module is used to send instant SMS alerts to farmers and drivers, ensuring reliable communication even in remote areas without internet connectivity. The system is powered by solar energy, making it suitable for continuous operation in rural and forest-adjacent regions. Detection events and alert data can be logged and monitored through an IoT platform for further analysis.The proposed system provides a cost-effective, scalable, and eco-friendly solution that enhances road safety, protects farmlands, and ensures ethical wildlife conservation through intelligent image- based decision-making.

A Study on the Influence of Nanoparticles on the Thermal Performance of Vapour Compression Systems"

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ABSTRACT

The growing demand for energy-efficient and environmentally sustainable cooling systems has accelerated research on advanced working fluids for refrigeration applications. Among emerging solutions, nano refrigerants refrigerants enhanced with nanoparticles have demonstrated significant potential in improving thermal performance while reducing energy consumption. This study presents a comprehensive analysis of the thermophysical, heat transfer, and system-level performance characteristics of nano refrigerants in vapour compression refrigeration (VCR) systems. Nanoparticles such as Al_2O_3, CuO, TiO_2, and carbon-based nanomaterials dispersed in conventional refrigerants and compressor lubricants enhance thermal conductivity, nucleate boiling, and convective heat transfer. The presence of nanoparticles improves compressor lubrication, reduces frictional losses, and enhances evaporator and condenser heat transfer coefficients. As a result, system performance indicators such as Coefficient of Performance (COP), cooling capacity, and energy efficiency ratio show measurable improvement compared to pure refrigerants. The paper also addresses critical factors including nanoparticle concentration, stability, compatibility with lubricants, pressure drop characteristics, and long-term reliability. Environmental aspects such as reduced power consumption and indirect emission reduction are discussed, highlighting nano refrigerants as a promising pathway toward sustainable refrigeration technology. The findings suggest that optimized nano refrigerant formulations can play a vital role in next- generation refrigeration and air-conditioning systems, contributing to enhanced energy efficiency and reduced environmental impact.

Ultra-Fast Charging of Electric Vehicle Using SEPIC Converter

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ABSTRACT

This project presents an ultra-fast electric vehicle (EV) charging system based on a Single-Ended Primary Inductor Converter (SEPIC) integrated with the utility grid. The AC power supplied from the grid is first converted into DC and then regulated using the SEPIC converter to match the required EV battery voltage and current levels. The SEPIC topology is chosen due to its ability to operate in both step-up and step-down modes, ensuring stable and reliable charging even under grid voltage

fluctuations. A closed-loop control strategy is implemented to maintain constant output voltage and current, thereby improving charging efficiency, power quality, and battery safety. The proposed system significantly reduces charging time and is well suited for DC fast-charging stations and smart grid- based electric vehicle applications. Keywords: Electric Vehicle, Ultra-Fast Charging, SEPIC Converter, DC–DC Converter, Closed-Loop Control, Smart Grid The global transition towards sustainable and environmentally friendly transportation has led to the rapid growth of electric vehicles (EVs) as an effective alternative to conventional fossil fuel–based automobiles. With increasing EV adoption, the development of efficient, reliable, and ultra-fast charging systems has become a critical requirement to overcome range anxiety and long charging durations. One of the major challenges in existing EV charging infrastructure is the limited charging speed caused by inefficient power conversion stages, voltage instability, increased thermal stress, and inadequate battery management. These limitations negatively affect battery life, system reliability, and overall user convenience. Hence, the design of an advanced EV charging system capable of delivering high power with improved efficiency and precise control is essential. This project proposes the design and development of an ultra-fast electric vehicle charging system based on a Single-Ended Primary Inductor Converter (SEPIC). The SEPIC converter is a versatile DC–DC power electronic topology that offers both step-up and step-down voltage conversion while maintaining a non-inverted output voltage. This unique feature makes it highly suitable for EV charging applications where the input voltage may vary due to grid fluctuations, renewable energy integration, or hybrid energy storage systems. Unlike conventional buck or boost converters, the SEPIC converter provides greater flexibility and improved voltage regulation, ensuring uninterrupted charging performance under varying operating conditions.

EXPERIMENTAL INVESTIGATION AND OPTIMIZATION OF PROCESS PARAMETER OF HIGH SPEED HARD TURNING PROCESS ON EN 8 STEEL

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ABSTRACT

Tool wear is a major problem encountered in manufacturing industry during machining operations. A substantial work on online tool wear monitoring system has been reported in order to improve the quality of machining parts, to reduce the machine damage, and cost of machining. The use of high strength and heat resistant materials is increasing day by day in aerospace, automotive, steam turbines and nuclear applications. The hard-turning process is steadily finding its place in modern manufacturing technology and with advance cutting tool materials it can be applied as alternative machining process to grinding providing a more economical way to finish hard surfaces. The main concerns of hard turning are tooling cost and the effect of process on machinability characteristics. The poor selection of process parameters may cause excessive tool wear and increased surface roughness. Hence there is a need to find the right parameters to achieve the right dimensional accuracy, good surface and maximum material removal rate. This paper presents an experimental investigation of finish hard turning under dry conditions using coated carbide tools. In this experimental the combination of Taguchi method along with analysis of various parameters when high speed CNC hard turning of EN8 steel alloy has to be considered.

Design and implementation of escalator layout development for an industry case study

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ABSTRACT

This project presents the design and implementation of an escalator layout development process under non-standard customer requirements, known as D-Option conditions. Customer inputs are captured through the T&O order form system and used to identify special design constraints. Technical reference documents such as D01, FG02, FG15, and FG16 are retrieved from the PDM system to support reaction force and structural calculations. To improve efficiency and reduce manual errors, reaction force calculations are automated using an Excel-based tool that applies cut-off values and logical conditions derived from the order form data. Based on the calculated reactions, the escalator layout is developed using AutoCAD software in compliance with engineering standards. The design undergoes internal checking, followed by tender approval, and the finalized drawings and calculation documents are stored in the PDM system for traceability and future use.

SMART IRRIGATION SYSTEM TO PREDICT OPTIMAL WATERING SCHEDULES

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ABSTRACT

Agriculture is a major consumer of freshwater resources, and inefficient irrigation practices often result in water wastage and poor crop yield. Most existing smart irrigation solutions depend on physical sensors, which increase system cost, require regular maintenance, and are not suitable for large-scale or small-holder farming. To overcome these limitations, this project proposes a sensor-independent smart irrigation system based on machine learning techniques. The system predicts optimal irrigation schedules using historical weather data, rainfall information, soil type, crop type, and seasonal conditions. After data preprocessing and feature selection, machine learning models such as Linear Regression and Random Forest are trained to estimate irrigation timing and water requirements. The predicted results are presented through a user-friendly web dashboard to assist farmers in making informed irrigation decisions. By eliminating the need for sensors, the proposed system provides a cost-effective, scalable, and sustainable solution that supports efficient water management and improved agricultural productivity. Keywords: Smart Irrigation, Sensor-Free System, Machine Learning, Water Conservation, Precision Agriculture.

Secure E-Voting System with Biometric Authentication and Anti-Spoofing Technology

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ABSTRACT

Electronic Voting Machines (EVMs) are widely used due to their efficiency and speed, but concerns regarding security, voter impersonation, and data integrity remain critical challenges. This paper proposes a secure e-voting system that integrates biometric authentication, face recognition with anti-spoofing technology, and cloud-based database monitoring. The system captures the voter's face at the polling booth, verifies it against a pre-registered database, and ensures liveness to prevent spoofing attacks using photographs or videos. Only authenticated voters are allowed to cast their vote. Voting records are securely stored and monitored using a cloud database, ensuring transparency, real-time monitoring, and data integrity. This approach significantly reduces electoral fraud and enhances trust in the voting process.

AI-Driven Predictive Plant Disease Diagnosis and Autonomous Treatment System Using IoT

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ABSTRACT

Agriculture has been the mainstay of food production across the globe, but diseases affecting plants have been causing significant crop losses during the growing seasons, which can have serious repercussions for food security and the livelihoods of farmers. This project proposes an innovative AI technology that can help detect diseases affecting plants at an early stage and provide autonomous recommendations for the treatment of the diseases using IoT technology. The proposed AI technology combines the latest advancements in image processing for visual disease detection, deep learning algorithms like Convolutional Neural Networks (CNN) for feature extraction from images of leaves of the plants, and Long Short-Term Memory (LSTM) for predicting the progression of diseases affecting the plants, along with the fusion of real-time sensor data using IoT technology like NodeMCU ESP8266. This technology can provide accurate predictions for the diseases affecting the plants by analyzing the images of the plants along with the data obtained from sensors measuring various environmental factors like moisture levels, temperature, and humidity. The innovations of the proposed technology lie in the fusion of machine learning algorithms like CNN and LSTM for accurate predictions of the diseases affecting the plants, the autonomous recommendations for the treatment of the diseases, and the precision agriculture technology using IoT technology like NodeMCU ESP8266 for easy deployment of the technology for the farmers.[1][2].

Keywords : Predictive plant disease diagnosis, Autonomous treatment, IoT agriculture, CNN & LSTM Algorithm, NodeMCU ESP8266, Machine learning fusion, Precision agriculture.

Smart Healthcare Appointment Scheduling Using an NLP Chatbot

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ABSTRACT

The rapid advancement of digital healthcare technologies has transformed the way patients interact with medical services. This project presents an Intelligent Doctor Appointment and Healthcare Assistance System that integrates an online appointment booking platform with an AI-based chatbot to enhance patient accessibility, efficiency, and decision-making in healthcare services. The system is designed to minimize manual processes, reduce waiting times, and provide preliminary medical guidance to users before consulting a doctor. The proposed system allows patients to search for doctors based on specialization, view doctor availability, and book appointments online through a user-friendly web interface. Administrators can manage doctors, specializations, appointments, and

approvals, while doctors can view patient details, update appointment statuses, provide remarks, prescriptions, and recommended medical tests. This structured workflow ensures smooth communication among administrators, doctors, and patients. A key feature of the system is the intelligent healthcare chatbot, which interacts with users by collecting symptoms and providing basic health guidelines. Based on the symptoms entered, the chatbot recommends suitable medical specializations, helping users make informed decisions regarding their healthcare needs. Additionally, the chatbot provides a direct appointment booking link, enabling users to schedule consultations seamlessly without navigating multiple pages. The system is developed using Django framework, Python, HTML, CSS, JavaScript, and SQLite/MySQL database, ensuring scalability, security, and reliability. By combining appointment automation with intelligent symptom-based guidance, the system enhances patient engagement, reduces administrative workload, and improves overall healthcare service delivery. This project demonstrates how integrating web technologies with conversational AI can significantly improve the efficiency, accessibility, and quality of modern healthcare systems, making it suitable for hospitals, clinics, and
telemedicine platforms.

DESIGN AND FABRICATION OF UNMANNED AERIAL VEHICLE FOR MONITORING OF OIL AND GAS PLANT

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EXCEL ENGINEERING COLLEGE

ABSTRACT

An Unmanned Aerial Vehicle or UAV is a vehicle that can fly with minimal intervention. This project involves in designing and integrating UAV technologies into a prototype that stabilizes itself while navigating in the harsh conditions of oil and gas plant. The project does not use existing commercial UAVs and flight controller board in the market. self-fabricated prototype of UAV is built from scratch. The prototype consists of a structure made of aluminum and four brushless DC motor to provide lift-off and maneuver the flight motion. The controls is embedded in a microcontroller and is equipped with electronic speed controllers to drive the motor, sensors such as gyroscopes and accelerometers to give orientation feedback and uses wireless communications via Xbee modules. The microcontroller receives command from a personal computer via the Xbee modules. A Graphical User Interface (GUI) is developed in software called Processing for monitoring and maneuvering purposes. For the chassis, it is modeled using Autodesk Inventor software to ensure design applicable.The expected outcome of this project is a complete prototype that can be controlled from a personal computer (PC).

Development of a Scalable Bituminous APP Solution for Flood-Resistant EV Battery PETG Housings.

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ABSTRACT

Flood damage is a severe concern for electric vehicle (EV) battery systems that result from water intrusion, hydrostatic pressure and inefficiency of traditional sealing means. Here follows a study on the design of flood proof electric vehicle (EV) battery housing made with hybrid material system which consists of additively manufactured Polyethylene Terephthalate Glycol (PETG), and APP–modified bituminous layer This research work is an investigation on the development of scalable, flood-resistant EV battery housing. The FDM printed PETG shell enhances structural integrity, chemical resistance and dimensional stability with inside ribbing and honeycomb geometries to support added mechanical load distribution. The APP- modified bituminous layer is heat bonded to the PETG shell,where it penetrates surface roughness and microtopography of the walls of the PETG shell to bond securely through thermo- adhesion and mechanical interlocking to create fraction-free integral waterproofing. The mechanical and sealing properties were tested experimentally and by numerical simulation. The housing exhibited a compressive load of 90.60 kN and average flexural strength of 62.8 MPa indicating that it could bear hydrostatic pressure, external mechanical forces in flood situations. It passed immersion test in 3 ft (1 m) of water for 24 hours without leaking, making it ready to resist being submerged in a flood up to IPX7 standards. The numerical studies by computational fluid dynamic and finite element methods were in excellent agreement with the experimental loading-unloading curves. The design provides a lightweight, cost effective, and robust solution for lithium-ion battery architectures and contributes to the overall safety and reliability of Electric Vehicles in flood prone regions. Keyword: Electric Vehicle Battery Housing; Flood-Resistant Design; PETG; APP-Modified Bituminous Layer; Additive Manufacturing; Waterproof Encapsulation;Mechanical Performance; CFD and FEA Analysis.

Talent Management and Organizational Development in Global Capability Centers in Industry 5.0 era

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ABSTRACT

Global Capability Centers (GCCs) are transforming from the basic cost-effective back offices to innovation and expertise hubs and, hence play crucial roles as testing grounds for Industry 5.0's

human-centric, sustainable, and resilient paradigm shift. Accordingly, this study reviews existing research contextualizes talent management (TM) and organizational development (OD) approaches within Industry 5.0 and, more broadly, its precursors, Industry 4.0. Based on the past researches in view of TM, human skills, and human-technology resiliency research into Industry 5.0, this study identifies that there are four themes of capability that appear to assume importance across GCCs, namely - digital and technical, adaptive and resilience, collaborative and cobot skills, managerial and leadership skills. Research into Industry 5.0 organizational approaches indicates that organizations that are cultivating Industry 5.0 are focusing on reskilling and upskilling employees and seeking to seamlessly merge soft skills, such as communication, problem-solving skills, creativity, and collaboration, into digital skills. Similarly, human-centric TM approaches seem to be moving beyond static, high-potential-only based approaches toward more fluid, systems approaches that connect talent management, development, mobility, and succession through continuous learning and flexible work arrangements.From the lens of OD, Industry 5.0 stipulates redesigning structures and cultures to ease the process of rapid individual upskilling and slower organizational absorption. Inclusion, empowerment, and employee involvement are embedded as drivers of innovation and performance. For GCCs, the review highlights persistent challenges—including digital capability gaps, resistance to change, contextualizing global practices, and managing globally distributed teams—alongside success factors such as leadership commitment, knowledge-sharing cultures, and human-centric HR technologies. The paper proposes an integrated TM–OD agenda that

DEVELOPMENT OF A SELF SUSTAINED POWER SYSTEM USING HUMAN BODY THERMOELECTRIC ENERGY AND RENEWABLE SOURCE

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ABSTRACT

Continuous glucose monitoring devices play a critical role in diabetes management, yet their dependence on conventional batteries limits long-term usability, increases maintenance requirements, and poses environmental concerns. This project proposes the development of a self-sustained power system for charging a glucose monitoring device by harvesting human body heat using thermoelectric generators (TEGs)in combination with solar energy as a supplementary renewable source. The proposed system utilizes the temperature difference between the human body and the surrounding environment to generate electrical energy based on the Seebeck effect. Thermoelectric modules integrated into the wearable glucose monitoring unit convert body heat into low-level electrical power. To overcome the inherent limitations of low power output from thermoelectric generators, a compact solar energy harvesting module is incorporated to enhance energy availability during daylight conditions. The hybrid energy harvesting approach ensures

improved reliability and continuous operation of the glucose monitoring device under varying environmental conditions. An efficient power management circuit is designed to regulate, boost, and store the harvested energy using rechargeable energy storage elements such as micro-batteries or supercapacitors. The regulated output provides a stable and safe power supply for the glucose sensor, signal processing unit, and wireless data transmission module. The system prioritizes low power consumption, patient safety, comfort, and uninterrupted glucose monitoring. The proposed self-powered charging solution reduces dependence on external charging methods and frequent battery replacement, thereby improving user convenience and device sustainability. By combining human body heat energy with solar power, this system demonstrates a practical and eco-friendly approach for powering wearable biomedical devices, contributing to advancements in renewable energy-based healthcare technologies and long-term diabetes management solutions.

Keywords:
Thermoelectric Generator (TEG), Human Body Heat Energy, Seebeck Effect, Self-Sustained Power System, Energy Harvesting, Hybrid Renewable Energy, Solar Energy Harvesting, Wearable Biomedical Devices, Continuous Glucose Monitoring, Power Management Circuit, Low-Power Electronics, Sustainable Healthcare Technology.

DIABOT: AI DRIVEN DIABETES RISK ASSESSMENT AND INTERACTIVE ADVISORY SYSTEM USING LIGHTGBM AND GENERATIVE AI

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ABSTRACT

The escalating global prevalence of Diabetes Mellitus, compounded by a critical shortage of specialized diagnostic infrastructure in underserved regions, necessitates innovative technological intervention to prevent delayed detection and its associated economic and health burdens. To address this, this project presents a holistic, AI driven framework that automates early-stage diabetes risk assessment using a fine tuned Light Gradient Boosting Machine (LightGBM) to analyze sixteen clinical symptomatic features with high precision. Distinguishing itself from standard "blackbox" classifiers, the system integrates a context- aware Generative AI interface that transforms predictive probabilities into empathetic, human readable narratives for personalized lifestyle and dietary advice. Furthermore, to ensure data integrity within digital health ecosystems, the framework incorporates "HashConnect," a lightweight, blockchain-inspired mechanism

that cryptographically seals diagnostic reports to guarantee immutability. This integrated solution aims to democratize access to medical expertise, reducing reliance on invasive testing while enabling early, actionable, and verifiable health interventions.

Keywords: Diabetes Prediction, LightGBM, Generative AI, Blockchain, Data Integrity, Explainable AI (XAI)

Alzheimer's Disease Detection Using MRI and Image Classification via Transfer Learning and Dense Net

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Abstract:

Alzheimer's disease (AD) is a progressive neurodegenerative disorder that impairs memory, cognitive function, reasoning, and daily living activities, significantly affecting the quality of life of millions worldwide. Early detection remains challenging due to subtle symptom onset and the complexity of conventional diagnostic procedures, which often rely on neurological examinations, neuroimaging, and cognitive assessments that can be time-consuming, costly, and subjective. To address these limitations, this study proposes a machine learning (ML) - based framework for the early prediction of Alzheimer's disease using clinical, demographic, and cognitive assessment data. The proposed system incorporates comprehensive data preprocessing techniques, including missing value imputation, normalization, feature encoding, and feature selection, to improve data quality and model performance. Multiple supervised learning algorithms - Logistic Regression, Support Vector Machine (SVM), Decision Tree, Random Forest, and Gradient Boosting - are implemented and comparatively evaluated to determine the most effective model for disease prediction. Feature importance analysis is performed to identify critical risk factors such as age, education level, cognitive test scores, brain volume metrics, and genetic indicators that influence disease progression. Model robustness and generalization are ensured using k-fold cross-validation. Performance is evaluated using accuracy, precision, recall, F1- score, and confusion matrix analysis. Experimental results indicate that ensemble methods, particularly Random Forest and Gradient Boosting, outperform other classifiers in predictive accuracy and reliability. Visualization tools such as correlation heatmaps, receiver operating characteristic (ROC) curves, and feature importance plots enhance interpretability and clinical relevance. The proposed framework supports early risk identification, enabling timely intervention, personalized treatment planning, and improved patient management while reducing reliance on manual diagnostic processes. This scalable and data-driven approach demonstrates strong potential for integration into clinical decision-support systems and remote healthcare applications.

Keywords: Alzheimer's disease, Machine learning, Early diagnosis, Predictive modelling, Random Forest, Gradient Boosting, Cognitive assessment, Healthcare analytics, Clinical decision support.

Variance-Constrained Dual-Channel LSTM Architecture for Adaptive Equity Forecasting

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Abstract:

Accurate stock market forecasting remains a challenging task due to nonlinear price dynamics, volatility clustering, and multiscale temporal dependencies. Although LSTM-based models effectively capture sequential patterns, their performance often degrades when long-term structural trends and short-term residual fluctuations are jointly modeled within a single representation space. This paper proposes a Dual-Stream Adaptive LSTM (DSA-LSTM) framework for robust financial time- series forecasting. The proposed architecture decomposes raw price series into trend and residual components and processes them through two parallel temporal learning streams. The trend stream captures macro-level directional movement, while the residual stream models high-frequency nonlinear volatility patterns. A dynamic feature-weighting mechanism is introduced to adaptively adjust the importance of engineered technical indicators across time steps, enabling context-aware representation learning under varying market conditions. To enhance stability, the framework incorporates variance-aware regularization to reduce prediction oscillation during volatile periods. The model is evaluated on historical equity datasets and assessed using MAE, MSE, RMSE, and directional accuracy metrics. Experimental results demonstrate improved robustness, lower prediction variance, and superior generalization compared to conventional statistical models and standalone deep learning baselines. The proposed architecture provides a scalable and adaptive solution for intelligent financial forecasting and decision-support systems operating in dynamic market environments.

Keywords

Stock Market Forecasting, Dual-Stream Learning, Adaptive Feature Weighting, LSTM, Trend–Residual Decomposition, Financial Time-Series, Volatility Modeling, Deep Learning.

An AI-Integrated Body Area Network for Energy-Efficient Continuous Health Monitoring

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Abstract:

The rapid advancement of wearable healthcare technologies has created new opportunities for continuous, real-time monitoring of physiological parameters, enabling early detection of medical abnormalities and improving patient care outside traditional clinical environments. This project presents the design and development of an AI-Integrated Body Area Network (BAN) Smartwatch capable of intelligent, energy-efficient, and continuous health monitoring using edge artificial intelligence. The proposed system integrates multiple biomedical sensors, including photoplethysmography (PPG), electrocardiogram (ECG), body temperature, motion, and additional physiological sensing modules, to capture vital health parameters such as heart rate, blood oxygen saturation (SpO_2), blood pressure trends, activity levels, and sleep patterns. Sensor data is acquired through low-power embedded controllers and processed locally using a Neural Processing Unit (NPU), enabling on-device inference for anomaly detection, trend analysis, and personalized baseline evaluation without constant cloud dependency. This edge- intelligence approach significantly reduces latency, enhances reliability in low-connectivity environments, and improves privacy by minimizing continuous external data transmission. When network connectivity is available, summarized health data is securely transmitted to cloud platforms for long-term storage, advanced analytics, and adaptive model retraining, thereby enabling a hybrid Edge–Cloud Healthcare Intelligence Framework. To address the critical challenge of wearable device power consumption, the system incorporates adaptive duty-cycle power management, intelligent sensor scheduling, and efficient battery regulation techniques, enabling multi-day operation using compact lithium-polymer battery storage. The device further enhances user interaction through voice-based alerts, haptic feedback, and visual notifications, allowing timely warnings during abnormal physiological conditions. A prototype implementation demonstrates reliable acquisition of ECG, heart rate, and SpO_2 signals, validating the feasibility of the proposed architecture for real-world wearable healthcare applications. The proposed system contributes toward next- generation personalized healthcare solutions by combining wearable sensing, embedded AI, energy-optimized design, and real-time decision support. This integrated approach supports the broader vision of proactive, accessible, and intelligent remote health monitoring systems aligned with global digital healthcare initiatives.

AI and IoT Cloud-Based System for Predicting Underground Water Availability and Estimating Underground Water Availability and Estimating Groundwater Depth

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R P SARATHY INSTITUTE OF TECHNOLOGY

Abstract:

Underground water is a vital resource that supports agriculture, drinking water supply, and ecosystem stability. However, locating and estimating the depth of groundwater reliably remains a challenge due to the complexity of subsurface geology and the variability of environmental factors. This paper presents an AI and IoT cloud-based system designed to predict underground water availability and estimate groundwater depth. The system integrates cloud-based data sources, including satellite imagery, historical rainfall data, soil composition maps, elevation data, and existing groundwater records. Machine learning models are employed to analyze these multi-source datasets and identify groundwater potential zones with high accuracy. By eliminating the dependency on physical on-site hardware and leveraging IoT cloud platforms for seamless data aggregation and transmission, the system significantly improves borewell drilling success rates while reducing operational and exploration costs. The cloud-based architecture enables scalability, real-time data processing, and accessibility across diverse geographical regions. Experimental results demonstrate that the proposed system outperforms traditional groundwater surveying methods in both accuracy and efficiency. This work contributes to sustainable groundwater management and supports informed decision-making for water resource planning.

Float Chat: AI-Powered Conversational Interface for ARGO Ocean Data Discovery and Visualization

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Abstract:

FloatChat is an AI-powered conversational analytics platform designed to simplify access to oceanographic data collected by the Argo Program, which provides large-scale measurements of temperature, salinity, and depth across the world’s oceans but stores them in complex NetCDF formats that are difficult for non-experts to interpret. Traditional methods require technical expertise, specialized software, and manual preprocessing, creating significant barriers to data exploration and insight generation. To overcome these limitations, FloatChat introduces a natural language interface that allows users to interact with ocean data through simple conversational queries, automatically translating user questions into structured database searches using Large Language Models combined with Retrieval Augmented Generation and semantic vector embeddings. The system processes raw NetCDF files into organized databases, retrieves relevant profiles intelligently, and presents results through an interactive chatbot and visualization dashboard for graphical, spatial, and temporal analysis. Key features include multi-profile comparison, Float NearMe location-based discovery, anomaly detection for unusual ocean patterns, API documentation, and a collaborative community forum. By integrating AI, semantic search, and real-time visualization, FloatChat reduces the technical complexity of marine data analysis and enables researchers, students, and policymakers to efficiently explore, understand, and derive actionable insights from large-scale oceanographic datasets, thereby accelerating scientific research and environmental decision-making.

Smart Manufacturing Web-Based Inventory & Logistics System for MSMEs

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Abstract:

Micro, Small, and Medium Enterprises (MSMEs) in remote areas face significant challenges in managing inventory and logistics operations. Many rely on manual record-keeping or disconnected systems, resulting in poor stock visibility, frequent stockouts, excess inventory, delayed deliveries, and inefficient demand forecasting. These limitations increase operational costs and negatively impact customer satisfaction and business growth. This paper proposes a web-based

Inventory and Logistics Management System tailored specifically for MSMEs in remote regions. The system offers a centralized digital platform for real-time inventory monitoring, automated low-stock alerts, streamlined order processing, improved delivery coordination, and enhanced supplier management. Designed with a user-friendly interface, the system enables non-technical business owners to efficiently manage operations without extensive training. Automated reporting and analytics support data-driven decision-making and better inventory planning. By transitioning from manual processes to a structured digital solution, the proposed system aims to increase operational efficiency, reduce costs, and strengthen the competitiveness and sustainability of MSMEs. Keywords: Inventory Management, MSMEs, Stock Monitoring, Low-Stock Alerts, Web- Based System, Logistics Management, Demand Planning, Real-Time Tracking, Supply Chain Optimization.

AI powered Energy Consumption optimization for Smart Homes using IOT

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Abstract:

The rapid increase in household electricity usage has created a demand for intelligent energy optimization solutions in smart residential environments. This study proposes an AI-powered Energy Management System (EMS) for IoT-enabled smart homes to enhance energy efficiency while preserving user comfort. The system utilizes IoT devices such as smart meters, motion sensors, and environmental sensors to acquire real-time data on appliance operation, occupancy patterns, and indoor conditions. Machine learning methods, including Random Forest, Decision Trees, and Artificial Neural Networks (ANN), are employed to analyze energy consumption behavior, detect inefficiencies, and forecast future demand. An intelligent control mechanism autonomously manages household appliances, including HVAC and lighting systems, by considering occupancy status, comfort preferences, and dynamic electricity pricing. In addition, the framework incorporates renewable energy sources and AI-driven optimization techniques to improve energy storage utilization and reduce dependence on the traditional power grid. Experimental simulations indicate potential energy savings of up to 25–30% while maintaining occupant comfort, demonstrating the practicality of the proposed system.

ANALYSIS AND TOPOLOGY OPTIMIZATION OF WHEELCHAIR USING GENERATIVE DESIGN

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Abstract:

The increasing performance demands of wheelchairs used in Paralympic wheelchair racing require improvements in existing designs. While current wheelchair designs are considered as the baseline, further enhancement is achieved through the application of generative design techniques, enabling optimized structural performance and significant weight reduction using Autodesk Fusion 360. However, conventional frame architecture is remodeled into a topology-optimized, load-path-driven structure to enhance the stiffness-to-weight ratio. As ergonomic frame geometry is refined based on standardized modeling and biomechanical constraints to improve propulsion kinematics and reduce musculoskeletal fatigue. Finite element analysis (FEA) was used to assess the simulation of static modal simulations to evaluate stress-strain behavior, deformation modes, stability margins, and safety factor distributions under realistic racing, braking, and maneuvering load cases. The optimized configuration demonstrates significant improvements in structural efficiency, dynamic stability, propulsion biomechanics, and energy transfer efficiency, validating the necessity and effectiveness of adaptive design for high-performance adaptive sports mobility systems. Keywords: Paralympic Wheelchair racing, Finite Element Analysis, Topology optimization, Autodesk Fusion 360, stiffness-to-weight ratio.

Design and Development of a Hybrid Solar-Assisted UAV for Extended Flight Endurance

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Abstract:

Unmanned aerial vehicles (UAVs) have their flight endurance limited by the restricted capacity of their energy storage systems. The research presents a hybrid solar-powered unmanned aerial vehicle which combines photovoltaic energy collection with a battery power system to extend flight time. The aircraft uses lightweight solar panels which are installed on its wings to generate extra power during flight operation, which results in lower battery usage. A power management system operates efficiently to control energy flow between the solar array and battery and propulsion unit. The design enhancement increases both endurance and operational efficiency which makes it appropriate for extended missions that involve surveillance and environmental monitoring tasks. Keyword: solar-powered; UAV; endurance extension; flight experiments.

ASSESSMENT OF GAP AND FLUSH VARIATIONS IN VEHICLE BODY PANELS AND THEIR EFFECT ON APPEAL QUALITY INDEX

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Abstract:

In the automotive industry, precise gap and flush alignment between vehicle body panels is essential for maintaining the Appeal Quality Index (AQI), structural integrity, and customer satisfaction. Minor deviations across panel locations can negatively impact vehicle appearance and quality consistency. This project presents an automated inspection system to measure gaps and flush at five critical vehicle locations using collaborative robots (cobots) integrated with a 3D camera and laser line scanning technology. The system combines 3D surface scanning, point-cloud data acquisition, and CAD-based comparison to ensure accurate and repeatable measurements. The cobot provides controlled movement for consistent data capture, and the scanned data is converted into a digital model for deviation analysis against design tolerances. A structured methodology involving area identification, reference point definition, and iterative correction ensures measurement precision. Inspection data is stored in a centralized database with visual dashboards for quick analysis. Overall, the system improves inspection accuracy (98%), repeatability, and contributes significantly to enhancing the vehicle's AQI (346, 792, etc..). Keywords: Gap and Flush, Appeal Quality Index (AQI), Collaborative Robots (Cobots), 3D Laser Scanning, CAD Comparison, Automotive Quality Inspection.

GAINURA : AI POWERED FINTECH SYSTEM FOR STOCKS

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Abstract:

Traditional stock market analysis and trading strategy validation methods have been predominantly manual, time-consuming, and prone to human bias. These processes often require extensive data collection, pattern recognition, and backtesting that can take days or weeks to complete effectively. This paper presents an integrated artificial intelligence-based system comprising two complementary frameworks: SageForge for algorithmic trading pattern validation and StockPulse for comprehensive stock intelligence analysis. The proposed system automates end-to- end stock analysis workflows from data acquisition through Angel One Smart API to machine learning-based price prediction and professional report generation. SageForge employs a sophisticated candlestick pattern detection engine that identifies Hammer and Inverted Hammer formations in 15-minute intraday data,

executing simulated backtests with configurable profit targets and stop-loss] parameters. The system validates pattern efficacy across multiple NSE stocks with sector-wise filtering capabilities. StockPulse integrates multi-source data pipelines combining real-time market data, web-scraped fundamentals from Screener.in, sentiment analysis from News API headlines using Text Blob NLP, and technical indicator calculations spanning 15+ metrics including Moving Averages, RSI, MACD, and Bollinger Bands. Machine learning models including Linear Regression and Random Forest generate 7/15/30-day price forecasts with confidence intervals, while vrisk assessment modules calculate volatility, beta, Sharpe ratio, and Value-at-Risk metrics. The system generates comprehensive 12-page PDF reports with 6 analytical visualizations and Excel exports for granular trade analysis. Simulation results demonstrate that the integrated framework achieves pattern detection accuracy exceeding 87% with backtesting execution speeds 40× faster than manual validation methods. The system reduces stock analysis time from 4-6 hours to under 3 minutes while providing data driven BUY/HOLD/SELL recommendations with quantified confidence scores. This work represents a paradigm shift from intuition- based trading to systematic, Algorithmic decision-making frameworks for retail investors and quantitative analysts. Keywords: Algorithmic Trading · Candlestick Pattern Recognition · Machine Learning Stock Prediction · Technical Analysis Automation · Sentiment Analysis · Backtesting Framework · Financial Data Pipeline · Risk Assessment.

SmartAssist: AI- Based Real-Time Guidance for Anganwadi Workers

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Abstract:

Anganwadi workers or child help assistant workers have been a constant support in guiding the rural environment in nutrition planning. However, less access to immediate health risk identification makes it difficult to avoid further problems. The system works by collecting basic information on the child by a user interface and it processes the collected data using rule-based decision logic written in the backend server. This particular method provides a way for instant assessment on risks related to potential nutrition and it offers practical guidance with ease. The entire system has a possibility in future integration of image-based analysis and for monitoring ongoing health trends cloud storage can also be used. By testing this structured prototype, we can understand the feasibility of simple deployment, AI tools that are effective in helping frontline workers on healthcare to identify earlier risks. Keywords - Anganwadi workers, health risk identification, rule-based decision logic, instant assessment, practical guidance.

Plant Doctor: An AI-Based Plant Disease Detection and Agri E-Commerce System Using Flask and MongoDB

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R P SARATHY INSTITUTE OF TECHNOLOGY

Abstract:

Agriculture plays a crucial role in ensuring food security, rural employment, and economic sustainability. However, plant diseases significantly reduce crop yield and quality, particularly in rural areas where timely access to agricultural experts is limited. To address this challenge, this paper presents Plant Doctor, an AI-based web application designed for intelligent plant disease detection and integrated agricultural e-commerce support using the Flask framework and MongoDB database. The proposed system enables farmers to upload images of infected plant leaves through a user-friendly web interface developed using HTML, CSS, and JavaScript within the Flask environment. The backend is implemented in Python using the Flask framework, where a deep learning-based convolutional neural network (CNN) model processes the uploaded images to classify plant diseases with high accuracy. The trained model analyzes visual patterns such as discoloration, spots, and texture variations to identify the disease type and generate confidence scores. MongoDB, a scalable NoSQL database, is used to store farmer details, uploaded images, disease detection history, and product information efficiently. Beyond disease identification, the system provides detailed information including disease name, accuracy percentage, symptoms, and preventive measures. Additionally, an integrated e-commerce module recommends relevant agricultural products such as fertilizers, pesticides, and growth enhancers based on the detected disease. Farmers can directly purchase these products through the platform, creating a unified ecosystem that connects diagnosis with treatment solutions. The proposed solution is lightweight, scalable, and suitable for deployment as a web application, with potential future expansion into mobile and progressive web applications. Bycombining artificial intelligence with digital agricultural services, Plant Doctor aims to minimize crop loss, enhance productivity, and improve farmers' access to modern agricultural support systems.

ANALYSIS AND OPTIMIZATION OF STEERING KNUCKLE USING GENERATIVE DESIGN

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Abstract:

The steering knuckle is a critical load-bearing component in an automotive suspension system, responsible for transmitting vertical, lateral, and braking forces between the wheel assembly and the vehicle chassis. This paper focuses on the optimization of a conventional steering knuckle using generative design techniques in Autodesk Fusion 360. The primary evaluation parameter considered in this work is the Von Mises stress, as it represents the yielding criterion under combined stress states. The existing geometry is remodeled and optimized using Generative design under loading conditions. The optimized design is compared with the conventional model using Finite Element Analysis (FEA) to evaluate maximum Von Mises stress, stress distribution characteristics, total deformation, factor of safety, and percentage weight reduction. The results demonstrate improved stress distribution with reduced peak Von Mises stress and enhanced strength-to-weight ratio while maintaining structural safety under multi-axial loading conditions. The study highlights the effectiveness of generative design approaches for the development of lightweight Steering Knuckle. Keywords: Steering Knuckle, Generative Design, Finite Element Analysis, Autodesk Fusion 360, Structural Optimization, Strength-to-Weight Ratio, Multi-axial Loading.

DEEPFAKE VOICE AND VIDEO DETECTION USING DEEP LEARNING

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R P SARATHY INSTITUTE OF TECHNOLOGY

Abstract:

The rapid evolution of deep learning and generative models has enabled the creation of highly realistic synthetic audio and video content, commonly known as deepfakes. While such technologies have constructive applications in media production, education, and accessibility, their misuse presents significant societal risks, including identity fraud, political misinformation, financial scams, and reputational damage. The increasing quality and accessibility of deepfake generation tools have made manual detection unreliable, thereby necessitating automated, scalable, and accurate detection mechanisms. This study presents a comprehensive deep learning–based framework for the detection of both deepfake voice and video, aiming to enhance the integrity and trustworthiness of digital media. The proposed system employs a dual-modal detection approach that integrates visual and auditory analysis to identify inconsistencies introduced during the synthesis process. For video analysis, convolutional neural networks (CNNs) are utilized to extract spatial features such as facial texture, illumination inconsistencies, edge artifacts, eye blinking irregularities, and lip synchronization errors. Temporal dependencies across consecutive frames are modeled using long short-term memory (LSTM) networks to detect unnatural transitions and motion anomalies that are characteristic of manipulated videos. For audio analysis, deep neural networks process speech signals using spectral and prosodic features, including Mel-Frequency Cepstral Coefficients (MFCCs), pitch

contours, formant structures, and temporal rhythm patterns, enabling the identification of artifacts produced by voice cloning and speech synthesis models.

The framework is trained and validated using a diverse dataset containing both authentic and deepfake audio-video samples generated by multiple state-of-the-art synthesis techniques. A fusion strategy is adopted to combine the predictions from the audio and video modules, thereby improving robustness against modality-specific weaknesses. Performance is evaluated using standard classification metrics such as accuracy, precision, recall, F1-score, and receiver operating characteristic (ROC) curves to ensure consistency across different manipulation methods and content variations. Experimental results demonstrate that the proposed multi-modal deep learning model significantly outperforms unimodal detection approaches, achieving high detection accuracy even in challenging scenarios involving low-resolution videos, background noise, and compressed media. The system exhibits strong generalization capability across unseen deepfake generation techniques, indicating its suitability for real-world deployment. This research contributes a reliable and scalable solution for automated deepfake detection, with practical implications for digital forensics, social media monitoring, secure authentication systems, online journalism, and cybersecurity. By addressing both voice and video manipulation within a unified deep learning framework, the proposed approach offers a comprehensive defense against emerging synthetic media threats and supports ongoing efforts to preserve authenticity, accountability, and trust in the digital information ecosystem**.**

Design and Development of a Machine Learning–Based Framework for Crime detection and prediction Analysis Using Large-Scale Data.

G Sivasathiya, S Sobana, R Vijayalakshmi, G Yazhini.

Ramco Institute of Technology

Abstract:

Urban safety and crime prevention remain ongoing concerns in today's cities. This is especially true for large urban environments such as New York City, where there is a high population density. The ability to accurately predict trends in crime is essential for law enforcement officials to strategically allocate resources, prevent incidents, and improve the safety of the community. This research demonstrates a machine learning-based system that uses historical (past) data along with temporal patterns and advanced feature engineering techniques to project the number of crimes that will occur on a daily basis in a given area. This predictive model utilizes four different algorithms — LSTM, CatBoost, LightGBM and XGBoost — combined into a single weighted ensemble in order to achieve the most accurate prediction possible. The systems utilize cyclical temporal encodings (i.e., an encoding of the cycle of day/night, month/year), lagged values of the variable (e.g., number of crime incidents from previous days), rolling averages/statistics (i.e., averages/statistics based on previous values), and seasonal trends (i.e., trends associated with each new season), all designed to

model the complexity of criminal behavior. The application provides high-risk time periods, displays historical trends on interactive dashboards, and provides insights for each borough regarding the time of year, day of week, and time of day in order to identify the high-risk areas and times of the week. The application will provide real-time access to both forecasts and aggregated crime forecasts via a web-based interface built using Streamlit. Additionally, there is a fallback mechanism in place should there be a failure to load a model so that the application can maintain continuous operations. The findings highlight the significant predictive capability of this application and document the high-risk periods and locations in order to inform law enforcement agencies and city agencies regarding proactive urban safety management through predictive analytics and user friendly access. Keywords: Crime Analysis, Crime Prediction, Machine Learning, Data Mining, Predictive Analytics, Classification Algorithms, Time-Series Forecasting, Crime Hotspot Detection, Data Visualization, Public Safety.

Few-Shot Learning with Wigner–Ville Distribution Features for Robust Power Quality Disturbance Detection and Classification

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NPR COLLEGE OF ENGINEERING AND TECHNOLOGY

Abstract:

Exact spotting and sorting of power quality disturbances (PQDs) is crucial for securing trustworthiness and constancy in today's power networks. Classical trait pulling out and machine learning techniques often demand huge tagged data collections, which are not always workable in actual settings. To deal with this problem, this effort puts forward a fresh structure that merges Wigner–Ville Distribution (WVD) based time–frequency traits with Few-Shot Learning (FSL) for strong PQD spotting and sorting. The WVD gives high- definition combined time–frequency views, permitting useful depiction of short-lived and changing PQ signs. A Few-Shot learning model is then utilized to sort disturbances with very little training data, massively cutting down the need for huge tagged data collections. Ten forms of mixed disturbances, like sag with harmonics, swell with flicker, and other complicated events, are looked at to check the technique. All imitations and examinations are done in MATLAB. Findings reveal higher exactness, flexibility, and strength against usual classifiers, underscoring the capability of the put-forward tactic for real-world power system watching.

Leveraging AI for Automated Code Review in Software Development

Mathangi N,YogithaN,Harshini M.

Meenakshi Sundararajan Engineering College

Abstract:

The rapid increase in the usage of generative artificial intelligence in software development has significantly reduced the time consumption of a developer. however, ensuring code security and quality remains as a key challenge. Existing automated code review techniques often undergo the disadvantage of limited language support, superficial contextual understanding, and reliance on single-model analysis, which restrict their effectiveness in identifying multifaceted vulnerabilities and security threats. This paper proposes a multi-agent, language-agnostic automated code analysis framework designed to detect vulnerabilities and potential threats in software codebases during the development lifecycle. The presented system employs language parsing techniques to hypothetical syntactic and semantic structures, enabling analysis across multiple programming languages without dependence on language-specific rules. A integrated set of specialized agents collaboratively performs static analysis, vulnerability detection, threat identification, and validation of findings, improving efficiency and reducing false positives. By integrating agent collaboration with contextual code understanding, the framework addresses pivotal limitations observed in existing generative-AI-based theories, including context blindness and language dependency. Experimental evaluation on representative software code samples highlights that the proposed approach improves vulnerability detection consistency while maintaining adaptability across diverse programming environments. The results indicate that multi- agent, language-agnostic analysis provides a scalable and reliable direction for protected and automated software development.

Design of a Smart Wall-Climbing Glass Cleaning Robot Using Autodesk Fusion 360

Mohamed Aslam G,ArputharajT,Karthickraja R.

Bannari Amman Institute of Technology

Abstract:

The maintenance of high-rise building facades presents significant safety and operational challenges. This study presents the conceptual design and structural optimization of a Smart Wall-Climbing Glass Cleaning Robot capable of autonomous or remote-controlled operation. The system integrates a vacuum-based negative pressure adhesion mechanism to generate sufficient normal force for vertical stability while minimizing energy consumption. The robot architecture is developed in Autodesk Fusion 360 within dimensional constraints (<100 cm) and incorporates modular subsystems for adhesion, locomotion, cleaning, and liquid dispensing. A critical load-bearing component of the chassis is optimized using Generative Design to enhance the strength-to-weight ratio. Multi-axial loading conditions representing self-weight, motor torque, and suction forces are applied. Finite Element Analysis (FEA) is conducted to evaluate Von Mises stress distribution, total deformation, and factor of safety. Results indicate improved stress uniformity, reduced peak stress concentrations, and significant mass reduction without compromising structural integrity. Integration of IoT-based communication and mobile application control enables real-time monitoring and smart

operation, aligning the system with Industry 4.0 principles.The study demonstrates the effectiveness of generative design-driven optimization in developing a lightweight, structurally efficient, and intelligent wall-climbing robotic system for facade maintenance applications.

AI-Driven Smart Traffic Signal Control for Intelligent Urban Mobility

RAGHUPRASANTH D,KARVENDHANC,KESAVAMOORTHY G.

BANNARI AMMAN INSTITUTE OF TECHNOLOGY

Abstract:

urbanization and the exponential growth of vehicular traffic have exacerbated congestion in contemporary metropolitan areas, posing challenges to mobility, environmental sustainability, and road safety. Conventional fixed-time traffic signal systems operate without consideration for real-time traffic conditions, often resulting in suboptimal traffic flow, prolonged waiting periods, increased fuel consumption, and elevated emissions. To address these limitations, this study presents an AI-powered Intelligent Traffic Signal Controller that dynamically adjusts signal timings based on lane-wise traffic density. The proposed system leverages computer vision and deep learning techniques, employing the YOLO (You Only Look Once) object detection framework to accurately detect and count vehicles from live video feeds captured by standard surveillance cameras. A dynamic timing algorithm proportionally allocates green signal durations according to real-time traffic intensity, ensuring smoother vehicular movement and minimizing congestion. By eliminating the need for costly embedded road sensors, the solution is cost-effective, scalable, and easily deployable within existing urban infrastructure. Furthermore, the system facilitates traffic pattern analytics, real-time monitoring, and emergency vehicle prioritization. The results demonstrate that AI-driven traffic management significantly outperforms traditional fixed- time control, offering a flexible, efficient, and intelligent approach for modern urban traffic regulation while promoting sustainability, safety, and operational efficiency.

AI-Driven Data Analytics Automations Tool

BHARATH S ,AnshuganeshBembare. B,Anbarasu. T.

R P Sarathy Institute of technology

Abstract:

The growing volume and complexity of data across modern applications demand intelligent analytics solutions that reduce manual effort and improve accessibility. Traditional data analytics and visualization tools often require technical expertise, extensive configuration, and manual interpretation, which limits their usability for non-technical users. This paper presents an AI-Driven Data Analytics Automation Tool, a web-based system designed to automate data analysis,

visualization generation, and insight discovery from raw datasets. The proposed tool enables users to upload datasets in CSV format and automatically performs data profiling, attribute classification, and intelligent visualization selection. It integrates interactive dashboards, tabular data exploration, and an AI-assisted natural language query interface to support intuitive insight extraction. The system is implemented using modern web technologies with a modular backend architecture to ensure scalability and flexibility. Experimental evaluation on real-world datasets demonstrates improved efficiency, accurate visualization generation, and high user satisfaction during exploratory data analysis. The proposed tool supports the objectives of computational intelligence and Industry 5.0 by democratizing data analytics and enabling intelligent, human-centric decision-making systems.

OPTIMIZED AND IMPROVED WIRELESS POWER TRANSFER SYSTEM

Dr.L.Anbarasu,S.Kaviya,V.Geetha.

ERODE SENGUNTHAR ENGINEERING COLLEGE

R P Sarathy Institute of technology

Abstract:

Wireless Power Transfer (WPT) has emerged as an important solution for powering remote, mobile, and embedded systems without the need for physical electrical connections. However, existing WPT systems face several limitations including low efficiency, limited transmission range, and reduced reliability under variable load conditions. This paper presents an optimized wireless power transfer system integrated with real-time monitoring using temperature, voltage, and current sensing modules. The system is based on a microcontroller-driven transmitter and receiver architecture, where operational parameters are sensed, processed, and transmitted wirelessly to ensure stable operation. The microcontroller dynamically regulates power levels and ensures safe operation, while the wireless communication channel transmits measurement data to a remote receiver unit for display on an LCD. This allows continuous observation of system performance without the need for wired feedback loops. The proposed system improves efficiency, reliability, and safety by incorporating intelligent control and adaptive monitoring. Experimental evaluation under various load conditions shows better performance stability compared to traditional fixed- frequency resonant WPT systems. The proposed design is suitable for applications in renewable energy systems, biomedical wearable devices, electric vehicle charging, and industrial automation. The research demonstrates that integrating monitoring and control feedback significantly enhances system robustness and paves the way for scalable, automated wireless power delivery platforms. Keywords Wireless Power Transfer, Microcontroller, Wireless Monitoring, Energy Efficiency, Sensor Integration, Power Electronics

Development of Radar-Based Living Person Detection System for Use Under the Rubble

Sukant L,Aditya K V,Vikash J.

BANNARI AMMAN INSTITUTE OF TECHNOLOGY

Abstract:

People are frequently trapped beneath debris during natural and man-made disasters like earthquakes, landslides, and building collapses. In these situations, finding survivors quickly is essential to the effectiveness of rescue efforts. When victims are unconscious or unable to produce sound or heat signatures, conventional search and rescue methods—such as physical inspection, acoustic sensing, sniffer dogs, and thermal imaging—face severe constraints in low-visibility situations. Due to these difficulties, there is now more interest in radar-based life detection systems that can detect human presence using non-contact sensing methods. In order to identify minute bodily movements brought on by breathing and other essential processes, radar-based living person detection devices send electromagnetic waves and examine returned signals. Radar technologies are ideal for post-disaster situations because they can pass through non-metallic impediments like concrete, bricks, and trash, unlike optical or acoustic approaches. The suggested system can differentiate between living people and stationary items beneath debris by utilising Doppler and micro-motion sensing concepts. Real-time signal analysis, filtering, and decision-making are made possible by the incorporation of embedded processing, enabling quick and accurate survivor detection.

Decentralized Predictive Intelligence for Multi-Tenant Task Platforms Using Federated Optimization

Kesavan M,Karthik P,Karthik G V.

R P Sarathy Institute of Technology

Abstract:

Multi-tenant task management platforms enable multiple organizations to operate on shared cloud infrastructure while maintaining strict logical data isolation. However, embedding predictive analytics within such environments presents a critical challenge: centralized model training conflicts with tenant-level privacy requirements and limits secure cross- organizational intelligence sharing. This paper introduces a Tenant-Aware Federated Learning framework for intelligent task delay prediction and workload monitoring in multi-tenant systems. Within the proposed architecture, each tenant independently trains a local predictive model using task lifecycle attributes, execution timelines, and user workload metrics. Instead of transmitting raw operational data, model parameters are aggregated through a federated optimization mechanism to construct a global model that preserves tenant privacy while enabling knowledge transfer across organizations.

The framework supports secure role-based access control and tenant-level logical isolation, ensuring compliance with distributed deployment requirements. Experimental evaluation compares centralized and federated training configurations using delay prediction accuracy and workload imbalance metrics. Results demonstrate that the proposed federated approach achieves competitive predictive performance while significantly enhancing data privacy and scalability. The study establishes that integrating federated learning into multi-tenant task management systems provides a secure, scalable, and intelligence-enabled solution for modern organizational workflow supervision.

A novel resilient power and density optimized buffer based router design using clock gating and RR

Dasari uday chandra,G.ravi kumar,K Hariveera prasad.

Sanskrithi school of engineering

Abstract:

Multi-tenant task management platforms enable multiple organizations to operate on shared cloud infrastructure while maintaining strict logical data isolation. However, embedding predictive analytics within such environments presents a critical challenge: centralized model training conflicts with tenant-level privacy requirements and limits secure cross- organizational intelligence sharing. This paper introduces a Tenant-Aware Federated Learning framework for intelligent task delay prediction and workload monitoring in multi-tenant systems. Within the proposed architecture, each tenant independently trains a local predictive model using task lifecycle attributes, execution timelines, and user workload metrics. Instead of transmitting raw operational data, model parameters are aggregated through a federated optimization mechanism to construct a global model that preserves tenant privacy while enabling knowledge transfer across organizations. The framework supports secure role-based access control and tenant-level logical isolation, ensuring compliance with distributed deployment requirements. Experimental evaluation compares centralized and federated training configurations using delay prediction accuracy and workload imbalance metrics. Results demonstrate that the proposed federated approach achieves competitive predictive performance while significantly enhancing data privacy and scalability.

Fatality Prevention in Cement Plant Rotating Equipment Using Machine Guarding and Conveyor Tripping Systems

SANJAY RAM K G, BHUVANESH N

Bannari Amman Institute of Technology

Abstract:

Cement manufacturing plants rely heavily on rotating machinery such as belt conveyors, crushers, pulleys, and rotary kilns for continuous material handling and processing. While these systems improve productivity, they also introduce serious safety challenges because workers are often required to operate and maintain equipment in close proximity to moving components. Incidents involving entanglement, trapping, and accidental contact with rotating parts remain one of the leading causes of severe injuries and fatalities in heavy industries. Therefore, there is a strong need for practical and reliable engineering solutions that can effectively control these hazards. This work proposes a preventive safety framework based on the combined application of machine guarding and conveyor tripping systems for rotating equipment in cement plants. The proposed approach restricts physical access to hazardous zones through properly designed protective guards and enables rapid emergency shutdown of conveyors using pull-cord-operated trip mechanisms and electrical interlocks. The framework is developed using a structured methodology that includes identification of critical hazards, assessment of existing safety gaps, development of preventive measures, and functional evaluation of the proposed solutions. The proposed system is designed in accordance with general industrial safety guidelines and standard machine guarding practices. The effectiveness of the proposed framework is assessed by comparing workplace conditions before and after implementation in terms of exposure to rotating parts, emergency response capability, and overall risk level. The results indicate a noticeable reduction in accident potential and improved response time during abnormal situations. The proposed system is simple, economical, and adaptable to existing industrial setups, making it suitable for large-scale adoption in cement plants. The outcomes of this study contribute toward strengthening occupational safety practices and supporting zero-accident objectives in industrial environments.Keywords: Machine Guarding, Conveyor Tripping System, Rotating Equipment Safety, Cement Plant Safety, Industrial Accident Prevention, Occupational Safety.

Power Efficient Low Latency Synthesisable Addition Using RNS and Verilog

D.A.Renuka, K.Likhitha, P.Rohitha

Sanskrithi School of Engineering

Abstract:

High performance adders are essential since the speed of the digital processor depends heavily on the speed of the adders used is the system. Also, it serves as a building block for synthesis of all other arithmetic operations. In present study, QSD number system eliminates carry propagation chain which reduces the computation time substantially, thus enhancing the speed of the machine. QSD Adder circuits are logic circuits designed to perform high-speed arithmetic operations.

As the number of digits is large a carry free addition is desirable by the exploitation of QSD number

and QSD addition achieve the carry free addition. As an extension of this concept, Residue Number System is proposed for low power addition strategies. The proposed RNS components are not only results in fast arithmetic operation and it also highly reduced the hardware complexity since it requires fewer amount of logic elements. In this work, the proposed components are implemented in different moduli sets reverse converter designs and the performances are compared for different values of n.

INVESTIGATION OF HYBRID CARBON / GLASS FIBER COMPOSITES FOR AIRCRAFT RUDDER AND ELEVATOR TRIM TABS

S MANIKANDAN , M SANJAY , Dr. VELMURUGAN PAVANAN

Abstract:

Hybrid composite is attracting a developing of scientific community. Two types of composite materials are used in this paper that material name is carbon fiber and glass fibers are chosen to be different material. While the glass fiber is low cost and easily available, carbon fiber is high-cost show much higher stiffness. Glass fiber and carbon fiber composites improvement of tensile test, Flexural test, Impact test, Water absorption test properties of good mechanical properties. In addition to that, Microstructure analysis of SEM (SCANNING ELECTRON STRUCTURE ANAIYSIS TEST), XRD (X- RAY DIFFRACTION TECHNIQUE TEST) AND C- FTIR (FOURIER TRANSFORM INFRARED SPECTROSCOPY TEST) also used to observe the microstructure of the composites. Hybrid composite is a good potential for the energy and structural applications .In this paper, we seek to investigate of the mechanical properties and microstructural modifications for fiber mixing and matrix modification. As a result, we seek to determine carbon fiber and glass fibers for a both material mixing hybrid Material factors and parameters can be used to the composite strength resistance.

AI-POWERED FRAMEWORKS IN AUTOMOTIVE PRODUCT LIFECYCLE MANAGEMENT: DRIVING DIGITAL TRANSFORMATION IN VEHICLE DEVELOPMENT

PALADI GOPIKRISHNA,Dr. Lakshmi K.S,

ISBR Business School, Bangalore

Abstract:

The automotive industry confronts mounting pressures to accelerate innovation, reduce costs, and transition toward electric and autonomous vehicles. Traditional Product Lifecycle Management (PLM) systems inadequately support software-defined vehicles requiring continuous integration, real-time simulation, and predictive validation. This research examines how AI-powered PLM frameworks enable digital transformation in automotive vehicle development. Research Objective This study measures AI-PLM impact on automotive development outcomes, identifies

high-value AI capabilities, determines critical implementation success factors, examines electrification and autonomy influences, and develops an Automotive AI-PLM Effectiveness Framework. The central question asks: How do AI-powered PLM frameworks impact vehicle development outcomes and drive digital transformation amid industry electrification and autonomy transitions? Methodology The research employs a mixed-methods design combining quantitative surveys of global automotive manufacturers with qualitative case studies. Statistical analyses include multiple regression and structural equation modeling to assess AI capability relationships with development outcomes. Case studies feature interviews with PLM directors, engineers, and AI leaders across OEMs and suppliers to explore implementation approaches and success strategies. Key Results AI-powered PLM frameworks significantly improve time-to-market, quality metrics, innovation output, and resource efficiency. Predictive analytics delivers the highest impact through design conflict detection, quality forecasting, and timeline prediction. Generative design enables substantial lightweighting while maintaining structural performance—essential for electric vehicle range. Critical success factors include digital thread maturity, supplier data integration, engineering culture adaptation, and cross-functional collaboration. Electrification-focused organizations achieve superior outcomes, indicating EV development creates favorable AI adoption conditions. Conclusion Successful AI-PLM implementation catalyzes broader digital transformation, accelerating digital twin adoption, connected vehicle analytics, and Industry 5.0 technologies. The proposed Automotive AI-PLM Effectiveness Framework integrates development complexity, electrification transitions, supplier dynamics, and regulatory requirements. This research provides empirical evidence of AI's transformative role in vehicle development, establishes performance benchmarks, and offers practical implementation guidance for automotive manufacturers navigating digital transformation amid technological disruption.

SMART FACE PAY:AI-ENABLED SECURE EMBEDDED DEVICE FOR DIGITAL TRANSFORMATION

SIVA N, AJAY BABU G, SUHASH M

JERUSALEM COLLEGE OF ENGINEERING

Abstract:

Face Pay is an innovative contactless payment system that integrates Artificial Intelligence (AI) and embedded systems to enable secure, real-time facial recognition–based transactions. The system is developed using a Raspberry Pi as the primary processing unit, coupled with a Pi Camera for real-time image capture. A Face Api.JS library-based facial recognition model serves as the core of the application, accurately identifying and verifying users by comparing live

facial data against a pre- registered database. To ensure user privacy and fast processing, all facial recognition operations are performed locally on the Raspberry Pi. Upon successful authentication, the system triggers a secure payment process through an integrated payment gateway. Advanced encryption and anti-spoofing techniques are incorporated to safeguard biometric data and prevent unauthorized access. Face Pay offers significant advantages such as faster, more hygienic, and card-free transactions, making it highly applicable in retail, public transportation, and smart access control systems. Ongoing enhancements in AI algorithms and embedded hardware continue to address challenges related to varying lighting conditions, facial orientations, and data privacy, reinforcing the system's reliability and scalability for real-world applications.

Truthify: fake news detector

Jai Sarath N, Lohit R, Lakshmi Prabha S

Bannari Amman Institute of Technology

Abstract:

The rapid growth of digital media and social networking platforms has made information sharing faster and more convenient. But this development has also resulted in the mass distribution of false information, fake news, and AI-generated content, especially screenshots and photos. Because image-based news seems so real, it is hard for users to manually check its veracity. Such false information can cause social unrest, public panic, and poor decision-making if it is allowed to proliferate unchecked. This project presents a Fake News Detector that uses artificial intelligence and machine learning techniques to analyze news content and classify it as Real or Fake. The system processes news data, extracts important features, and applies a trained machine learning model to identify misleading or false information. The detector provides quick and reliable results, helping users verify news before believing or sharing it. The proposed system improves the efficiency of news verification and supports responsible information sharing. By automating the fake news detection process, the system helps reduce the spread of misinformation and enhances trust in digital news platforms.

KEYWORDS

Fake News Detector, Misinformation Detection, Machine Learning, Artificial Intelligence, News Verification, Digital Media, Online News

An Integrated Wearable Device For Real-Time Pregnancy Fall Detection and Amniotic Rupture Fall Detection

Mrs. S. Vinitha, Dr. D. Parameswari, Palkis Beevi J

Jerusalem College of Engineering

Abstract:

Pregnancy is a critical biological phase that demands continuous supervision to safeguard both maternal and fetal well-being. Sudden accidental falls and premature rupture of membranes represent two major complications that can lead to serious medical consequences if not identified at an early stage. In many existing healthcare setups, emergency conditions are recognized only after manual reporting or clinical observation, which may delay medical intervention. To overcome this limitation, this paper presents a novel integrated wearable system designed to monitor fall incidents and detect possible amniotic fluid leakage in real time, supported by a centralized cloud-based hospital monitoring platform. The proposed system combines motion sensing and biochemical analysis within a unified Internet of Things (IoT) architecture. A wearable module equipped with an Inertial Measurement Unit (IMU) continuously tracks tri-axial acceleration and angular velocity to identify abnormal movement patterns associated with fall events. The resultant acceleration is computed using vector magnitude analysis, and a dual-threshold validation mechanism is applied to differentiate between routine movements and genuine fall conditions. In addition to motion monitoring, a calibrated pH sensing module is incorporated to identify changes in fluid acidity levels. Since normal vaginal pH values differ significantly from those of amniotic fluid, threshold-based comparison enables early indication of membrane rupture. The wearable unit operates on an embedded microcontroller platform that performs real-time signal processing, event validation, and tructured alert generation. When an emergency condition is confirmed, the system transmits critical information, including patient identification, event type, severity classification, timestamp, and geographical coordinates, to a cloud server via wireless communication. A web-based hospital dashboard provides real-time visualization of alerts, enabling healthcare professionals to prioritize cases and respond rapidly. Experimental validation conducted under simulated fall scenarios and controlled pH conditions demonstrates reliable detection performance with minimal latency in alert delivery. The modular architecture allows scalability for multi-patient and multi-hospital deployment. This research contributes toward the development of intelligent, connected healthcare technologies capable of supporting safer and more responsive maternal monitoring systems

Privacy Preserving Alzheimer's Disease Prediction through Federated Learning on Multimodal data

Mareeswari G, Ananthi P,Nandhini S

Ramco Institute of Technology

Abstract:

Alzheimer's disease affects over 55 million people globally, making reliable and timely diagnosis one of the most pressing problems in clinical neurology. Centralised machine learning

systems have shown promise in detecting cognitive decline, but they require pooling sensitive patient data from multiple hospitals — a practice that runs directly against patient privacy laws such as HIPAA and GDPR. This paper describes a federated learning framework that trains on clinical records and MRI brain scans held across three simulated hospital nodes without ever moving raw data outside those nodes. The system runs the FedProx algorithm with a proximal coefficient of 0.01 to handle the non-uniform data distributions that naturally arise when different hospitals serve different patient populations. On the clinical side, a Random Forest classifier processes 32 patient attributes including MMSE scores, Activities of Daily Living, and demographic variables. On the imaging side, a MobileNetV2 convolutional network classifies 128×128 MRI scans into three diagnostic stages: Normal Cognition, Mild Cognitive Impairment, and Alzheimer's Disease. SMOTE is used to correct class imbalance in the clinical dataset, and three-fold image augmentation compensates for limited scan availability. Predictions from both pathways are merged through a weighted ensemble that gives 40% weight to clinical scores and 60% to imaging findings. SHAP TreeExplainer is applied to the Random Forest to explain which patient features drive each clinical prediction. The complete pipeline is accessible through a Flask web dashboard where clinicians can enter patient data and upload MRI scans to receive a real-time diagnosis. Across five federated rounds, the clinical model reaches 89.4% accuracy, the MRI model reaches 87.0%, and the combined ensemble achieves 92.3%.

FARMER'S BOT

GANESH K, SELIN STEPHEN L,MOHAMED WASEEM M

PERIYAR MANIAMMAI INSTITUTE OF SCIENCE AND TECHNOLOGY

Abstract:

The agricultural welfare programs provide financial support and grant subsidies and offer insurance services to farmers, but most farmers do not know about their eligibility because they cannot navigate the complicated application process and they lack access to digital resources. The study introduces a WhatsApp-based chatbot which enables farmers to find their eligible schemes through a basic chat interface. The system gathers essential information through landholding size and income and crop type and location data to evaluate eligibility according to scheme requirements using rule-based logic and a decision-tree model. The pilot study with rural farmers showed that 90 percent of eligibility predictions were accurate while the farmers gained better understanding of the program. The chatbot provides an affordable solution which can be expanded to improve access to programs and deliver benefits to users.

Smart IV Monitoring System

Aarif Z, Balaprasath P, Ingarsal S, Praveenkumar R

Velammal Institute of Technology

ABSTRACT

Intravenous fluid administration is an essential part of modern healthcare due to its widespread use in patient treatment and emergency care. To support safe and continuous IV therapy, efficient and intelligent monitoring systems are required. Traditional IV systems only deliver fluid without providing information about remaining fluid level, flow status, or patient safety conditions. This system also supports nursing assistance by enabling early warning alerts and automatic flow control. With features such as real-time fluid level visualization, critical alerts, and automatic flow stoppage, the IV fluid monitoring system ensures safe, efficient, and nurse-friendly operation. It is widely applicable in hospitals, intensive care units, emergency wards, and general patient care areas.

Design and Implementation of Standalone PV Based EV Charging Microgrid

Dineshkumar D, Gowtham DS, Mageshwar P

Velammal Institute of Technology

ABSTRACT

This project focuses on the simulation and implementation of a standalone Solar PV based DC microgrid intended for electric vehicle (EV) charging applications. The proposed architecture integrates a photovoltaic array, DC–DC power conditioning stage, battery energy storage system, and regulated DC bus to ensure reliable power delivery under variable solar irradiance and dynamic charging demand. By adopting a DC distribution framework, the system minimizes conversion losses associated with conventional AC-based charging and enhances overall efficiency. The microgrid is modeled through simulation to evaluate key performance parameters such as DC bus voltage regulation, power flow stability, and battery charging–discharging behavior under different operating conditions. The results demonstrate that the proposed system can provide a sustainable, efficient, and cost-effective solution for EV charging in remote and grid-constrained regions.

AI-Powered Smart EV Charging with Battery Health Intelligence

Pavithra D, Haripriya S, Hemalatha A, Duvvuru Harshitha

Velammal Institute of Technology

ABSTRACT

The rapid adoption of electric vehicles (EVs) has intensified concerns related to battery degradation, safety, and inefficient charging practices. Conventional charging systems primarily focus on energy delivery while relying on vehicle embedded Battery Management Systems (BMS), which are often inaccessible to external chargers. To address these limitations, this paper proposes an

intelligent charger centric battery analytics framework that enables smart charging without direct access to the onboard BMS. The proposed system integrates charger side battery health inference, per session battery degradation prediction, real time adaptive charging control, a cloud based virtual BMS, and explainable battery analytics. Using voltage, current, and temperature data collected during charging, the system estimates battery health and predicts degradation risks for each charging session. Based on real-time battery stress indicators, the charging process is dynamically adjusted to minimize aging and thermal stress. A cloud based virtual BMS is developed to provide continuous monitoring, state estimation, and long-term battery behaviour analysis across multiple charging sessions. Furthermore, explainable analytics are incorporated to transparently identify and communicate the key factors contributing to battery degradation. The proposed framework enhances battery longevity, charging safety, and user trust, while offering a scalable and OEM independent solution for next generation smart EV charging infrastructure.

Keywords:

Electric Vehicle Charging, Smart Charging Systems, Battery Health Estimation, Battery Degradation Prediction, Adaptive Charging Control, Virtual Battery Management System, Explainable Artificial Intelligence, IoT based EV Infrastructure.

Solar Driven IOT Enabled Waste Management System

Harish J, Kamalesh S, Elancheziyan K

Velammal Institute of Technology

ABSTRACT

Rapid urbanization has intensified the challenges of solid waste management, with conventional collection methods often proving inefficient due to fixed schedules and manual inspections. These inefficiencies result in overflowing bins, increased fuel consumption, and higher operational costs. This project proposes a Solar-Powered IoT-Enabled Solid Waste Management System to address these issues by combining renewable energy with smart sensing technologies. The system equips waste bins with sensors that monitor waste levels and automatically segregate dry and wet waste, transmitting real-time data to a centralized monitoring server. A comprehensive dashboard allows authorities to visualize bin status, receive alerts, and optimize collection routes and schedules. Additionally, the system sends notifications directly to waste collectors when bins require emptying, ensuring timely and efficient waste collection. By reducing unnecessary collection trips, promoting proper waste segregation, and minimizing energy consumption and operational costs, the system provides a sustainable and intelligent solution for smart urban environments.

Integration of Renewable Energy Sources with Utility Grid–ConnectedElectric Vehicle

Chargers

Karishma M, Jeevitha S, Lathika Saran S, Hemambika B

Velammal Institute of Technology

ABSTRACT

The rapid growth of electric vehicles (EVs) demands efficient, reliable, and power-quality-compliant charging systems. Conventional EV chargers based on diode bridge rectifiers suffer from poor power factor, high harmonic distortion, and increased stress on power electronic components, making them unsuitable for modern grid standards. To address these issues, this project presents a grid-connected EV charging system integrated with a renewable energy source, employing an advanced interleaved Luo converter– based power factor pre-regulator and an isolated flyback converter. The proposed system accepts power from both the utility grid and a solar photovoltaic (PV) source, enabling hybrid operation and improved energy utilization. The interleaved Luo converter ensures high voltage gain, reduced input current ripple, and improved power factor, while minimizing switch stress and DC-link capacitor requirements. The flyback converter provides galvanic isolation and regulated low-ripple DC output suitable for EV battery charging. A microcontroller-based control scheme generates synchronized PWM pulses, and opto-couplers ensure safe isolation between control and power stages.Simulation and experimental considerations demonstrate that the proposed topology significantly improves input power quality, enhances efficiency, and supports sustainable EV charging.

A Centralized Monitoring System for Street Light Fault detection and location tracking.

Sowmiya M, Monisha P, Harsitha S.

Velammal Institute of Technology

ABSTRACT

The primary purpose of this project is to address the inefficiencies and challenges in the maintenance of street lights in Indian cities. By developing an automated system for defect detection and prevention, the project aims to improve the overall reliability and performance of street lighting infrastructure. Additionally, the project seeks to empower local authorities and linemen with advanced tools and technologies to enhance their capabilities in managing street light maintenance efficiently and effectively. The scope of the centralized monitoring system for street light fault detection and location tracking includes the design and implementation of an automated system capable of real-time monitoring, fault detection, and location identification of street lights. The project covers the integration of sensors, microcontrollers, communication technologies, and a centralized dashboard for data visualization and control. It can be extended to support large-scale deployment in smart cities,

highways, campuses, and municipal areas. The system also has future scope for energy management, remote control of street lights, predictive maintenance, integration with renewable energy sources, and advanced analytics to further improve efficiency, reduce operational costs, and enhance urban infrastructure management.

Causal AI–Powered Antifragile Healthcare Chatbot for Intelligent Medical Support

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Periyar Maniammai Institute of Science and Technology

Abstract:

Rural communities in India face a severe shortage of accessible healthcare, leaving millions without timely medical consultation. This paper presents a Causal AI- powered antifragile healthcare chatbot that delivers intelligent disease prediction through natural doctor-like conversation. The system combines Causal AI with
Machine Learning using the DoWhy framework to achieve 98.95% prediction accuracy on a medically verified dataset of 83 diseases and 323 symptoms. Causal AI reranking eliminates medically impossible predictions that purely statistical models produce. A Large Language Model powered by Ollama LLaMA3 enables natural doctor-like conversation, asking only one clinically relevant follow-up question derived directly from the Machine Learning prediction. An antifragile feedback loop built on Random Forest retraining continuously improves the model from user-corrected predictions. The system is deployed with a React.js frontend, Python Flask backend, and OpenStreetMap integration for locating nearby hospitals. Results show significant improvements over existing approaches in prediction accuracy and diagnostic relevance.

Keywords — Causal AI, Healthcare Chatbot, Antifragile Systems,Disease Prediction, Large Language Model, DoWhy, OpenStreetMap, Random Forest, Rural Healthcare.

INVESTIGATING THE PERFORMANCE OF ADDITIVELY MANUFACTURED TITANIUM ALLOY (Ti-6Al-4V) UNDER DISTINCT COOLING CONDITIONS

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Easwari Engineering College

Abstract:

Additive Manufacturing (AM) of Ti-6Al-4V has gained significant attention as a transformative manufacturing technology due to its capability to fabricate complex geometries with excellent mechanical strength, corrosion resistance, and biocompatibility. These attributes make it highly suitable for aerospace, biomedical, and automotive applications. However, the inherent layer-by-layer fabrication process of AM produces distinct microstructural characteristics, anisotropy, residual stresses, and surface irregularities, all of which significantly influence machinability. During post-processing operations such as machining, these features often result in elevated cutting temperatures, unstable chip formation, and accelerated tool wear, thereby affecting dimensional accuracy, surface integrity, and overall productivity. This study investigates the machining performance of additively manufactured Ti-6Al-4V, with particular emphasis on the influence of cutting temperature on tool wear mechanisms. Controlled machining experiments were conducted under varying cutting speeds and feed rates to systematically analyze temperature evolution and its interaction with tool degradation. Cutting temperature was measured in real time using thermal

sensors positioned close to the cutting zone, while tool wear was evaluated through detailed microscopic examination to identify dominant wear mechanisms, including adhesion, abrasion, diffusion, and oxidation. The results reveal strong correlations between machining parameters, temperature rise, and wear progression. Elevated cutting temperatures were found to significantly accelerate wear rates and reduce tool life compared to conventionally manufactured alloys. These findings provide valuable insights for optimizing cutting conditions, selecting appropriate tool materials and coatings, and implementing effective cooling strategies to improve machining efficiency and sustainability.

Outpatient Intelligent Summarizer

Surya V, Jaishini S , Janya R
E.G.S Pillay Engineering College

Abstract

The rapid growth of digital health records in outpatient departments has created a significant challenge for healthcare professionals seeking to efficiently review and utilize patient information within limited consultation time. Outpatient visits often produce large volumes of unstructured clinical data, which includes physician notes, diagnostic reports, prescriptions, and follow-up instructions. This paper presents an Outpatient Intelligent Summarizer, an AI-driven system designed to automatically generate concise, accurate, and clinically relevant summaries from outpatient medical records. The proposed system utilizes natural language processing (NLP) and machine learning techniques to extract key medical entities, including symptoms, diagnoses, medications, laboratory results, and treatment plans. By organizing and prioritizing critical patient information, the summarizer enables physicians to make faster clinical decisions and reduces the time spent on reviewing documentation. Additionally, the system enhances continuity of care by providing easily interpretable summaries for follow-up consultations. Experimental evaluations demonstrate that the intelligent summarizerimproves information accessibility, reduces cognitive load on healthcare professionals, and maintains high summarization accuracy. The proposed approach has the potential to enhance outpatient workflow efficiency, improve the quality of patient care, and support the adoption of intelligent clinical decision support systems in modern healthcare environments.

AI Driven Chatbot for Indian Law

Ms.S.Ilakkia, Malathi J, Nirmal Chander S K
Jerusalem College of Engineering

Abstract

The complexity of the legal framework in India is making it difficult for citizens to access and understand legal provisions and requirements. This is because most people are not able to access legal professionals immediately and therefore are not able to understand their rights and responsibilities on a timely basis. To mitigate this constraint, this paper proposes an AI-Driven Chatbot that is able to provide legal information on relevant topics of Indian law in a simplified and accurate manner. The proposed system will incorporate Natural Language Processing, machine learning, and transformer-based semantic modeling using a scalable web-based framework. The user queries will undergo a series of preprocessing steps, including tokenization, stopword removal, and normalization. The Convolutional Neural Networks (CNN) and Long Short-Term Memory (LSTM)

models will be used for intent classification, considering the context and sequential dependencies in user queries. The Naïve Bayes classifier will also be used for probabilistic legal domain classification. The LegalBERT model will be used for semantic-based legal provisions matching using cosine similarity. The backend is built using a Flask-based framework, with structured legal datasets held within a relational database. The summarization module provides users with clear explanations of complex legal text, making the law more accessible to users without sacrificing legal accuracy. The system provides structured responses with relevant sections, procedural information, and explanations. This has been validated by experimental evaluation, which shows enhanced performance with respect to intent classification and semantic retrieval accuracy. The proposed model facilitates the generation of real-time responses and ensures scalability. The proposed research will contribute to the development ofintelligent legal assistance systems with the aim of increasing public accessibility to Indian legal information in a safe, reliable, and interpretable manner.

VIBRATION ASSISTED AUTONOMOUS CLEANING SYSTEM FOR CONCRETE MIXERS

Dr.A.Sumaiya Begum, Dr.P. Poonkuzhali, V. Nikshitha
R.M.D. Engineering College

Abstract

Hardened cement accumulation inside mixer drums is a major maintenance issue in construction and ready-mix concrete industries. These deposits reduce mixing efficiency, increase mechanical wear, and require periodic cleaning. The conventional cleaning method involves manual entry of workers into confined drum spaces to chip away hardened cement, which poses serious safety risks such as suffocation, dust inhalation, and physical injury. Therefore, an automated and safe cleaning solution is required to eliminate hazardous human involvement and improve maintenance efficiency. This project proposes a vibration-assisted autonomous robotic system designed to clean hardened cement deposits inside mixer drums. The system consists of a mobile robotic platform built on a fiber chassis with DC shaft servo motors and wheels for movement on curved drum surfaces. Linear actuators and a solenoid actuator are used to position the cleaning tool and apply controlled impact forces. A vibration motor generates high-frequency oscillations that induce micro-fractures in the brittle cement layer, weakening adhesion and enabling easier removal. The robot is controlled using an embedded microcontroller, and real-time monitoring is provided through an ESP32 camera module with wireless video transmission. An ultrasonic sensor is incorporated to detect obstacles and ensure safe navigation inside the confined drum environment. Experimental evaluation confirmed that the vibration-assisted delamination mechanism effectively loosens hardened cement deposits while maintaining stable mobility and safe operation. The system reduces the mechanical force required for cleaning and minimizes structural stress on mixer blades. Compared to manual cleaning methods, the proposed robotic system improves worker safety, reduces maintenance time, and provides consistent cleaning performance. The developed solution demonstrates the feasibility of applying robotic automation for hazardous industrial cleaning tasks and offers a scalable approach for improving reliability and safety in cement mixer maintenance operations.

Next Gen-AI Code Debugger and Explainer for Multi-programming Language

B.HARISH SRIRAM,Dr.S.RAJARAJAN.
KINGS COLLEGE OF ENGINEERING, P

Abstract

A Next Gen-AI Code Debugger & Explainer for multi-programming languages, targeting the shortcomings of conventional code debuggers and the privacy issues related to cloud-based Al assistants. The proposed system integrates a hybrid framework that leverages a dual-processing paradigm: Google Gemini for high-parameter cloud reasoning and Code LLaMA/Gemma through Ollama for localized, privacy-preserving processing. The engine supports automatic multi-layer diagnostics, going beyond conventional syntax analysis to engage in deep-level repair of runtime errors and logical discrepancies. To fill the "conceptual gap" for newbies, the system includes human-centric pedagogical translation, rendering opaque technical metadata in natural language form. By focusing on an offline mode, the framework guarantees data residency and security, precluding the leakage of proprietary information while sustaining low-latency performance even in zero-connectivity settings. The proposed system, developed with the StreamLit framework, integrates code generation, debugging, and explanation within a single, interactive dashboard, providing a scalable and future-proof platform for contemporary software development.

Development of an Automated Public Restroom Sanitation Control Architecture Using Microcontroller Technology

Karthiyayini P,Hematharshini VK,Dr. Anbarasan P.
St.Joseph's Institute of Technology

Abstract

Smart sanitation infrastructure is a research project with technological orientation that aims at enhancing hygiene assurance, operational stability, and protection of human health in the conditions of shared restrooms. The inefficient maintenance programs within the urban, semi-urban, and rural sanitation systems promote the growth of microbes and spread of diseases, and the systematic sanitation control has not yet been fully addressed in the literature. The proposed research design proposes an inbuilt sanitation oversight design incorporating water-level control, automated waste, touchless sanitizer dispensing, occupancy identification, user registration, and smoke warning. An embedded controller with a compact commercial grade implementation coordinated on the ATmega365 platform triggers occupancy enumeration in response to restroom entry, and on reaching an intended threshold of ten users an alert communication is triggered together with a programmed chemical-assisted flush sequence then a two-cycle water flush is activated. The waste-bin lids are controlled by ultrasonic proximity sensing based on the interpretation of reflected acoustic signals, and thus, a contactless way of disposing waste is made possible. A distance triggered dispensing system is used to activate a servo-controlled sanitizer spray when the hand proximity sensor signalling pathways are overcome. The presence of a full-time water level surveillance will initiate an automated pumping module when the overhead storage capacity reduces to less than functional needs. The experimental validation was found to be functionally steady under real time conditions. The suggested sanitation management framework attained 96.8 percent total operational accuracy and the adopted output deployment model attained 95.9 percent accuracy of the sensing, control, and actuation processes. The research framework developed helps to facilitate the modernization of sanitation on a large scale, streamline the resources, and ensure compliance with hygiene in smart ecosystems of public infrastructure.

Development and Mechanical Characterization of Synthetic Spider Silk/Curaua Fiber Reinforced Hybrid Composites for High-Impact Structural Applications

P.STELLA JANSI RANI,S.SENTHIL KUMAR,M.SRIDHARAN.
Fatima Michael College of Engineering and Technologyc

Abstract

The increasing demand for sustainable structural retrofitting materials has accelerated the development of bio-based alternatives to conventional glass and carbon fiber–reinforced polymers (FRPs). Among natural fibers, Curaua (Ananas erectifolius) exhibits a high tensile modulus and favorable specific strength; however, its intrinsic brittleness and limited strain-to-failure restrict its applicability in seismic and high-rate loading environments. This study presents the design and mechanical evaluation of a ductile hybrid bio-composite system combining Amazonian Curaua fibers with bio-engineered synthetic spider silk to enhance fracture toughness and impact resistance while maintaining high stiffness. Hybrid laminates were fabricated via Vacuum-Assisted Resin Infusion (VARI) using a moisture-resistant bio-epoxy matrix. Three stacking architectures—symmetric interlayered, asymmetric gradient, and sandwich configurations—were developed to investigate structure–property relationships and failure mechanisms. Mechanical performance was assessed through tensile, flexural, and high-velocity impact testing to simulate debris impact and blast- type loading relevant to civil infrastructure. Hybridization with synthetic spider silk increased impact toughness by 45–60% relative to monolithic Curaua laminates. Fractographic analysis revealed that spider silk interlayers promoted crack deflection, interfacial bridging, and progressive delamination rather than catastrophic brittle fracture. In sandwich architectures, silk layers acted as energy-dissipative membranes, significantly delaying crack coalescence and suppressing unstable crack propagation. The resulting transition from brittle to pseudo-ductile failure is critical for seismic-resistant structural systems requiring controlled energy dissipation. The developed Curaua/Silk composite demonstrates a high specific stiffness, improved fracture resistance, and enhanced dynamic performance, highlighting its potential for sustainable seismic retrofitting, blast-resistant panels, and lightweight bridge decking. This work establishes a scalable materials framework for integrating bio-engineered polymers into high-performance structural composites for resilient infrastructure applications.

AI Optimization for Hybrid Sources in Battery Management System

Mr.P. Velmurugan,K.Vinothini,R.Krishnaveni.
R P Sarathy Institute of Technology

Abstract

This paper presents a hybrid power generation system that solar power and wind such as renewable energy supports regular electricity settings. Integrate with mixture of power production in stations for renewable energy out turn intermittent possibility and differ the load requirements causes challenges combat. Battery cells in the mixing of in active will be enabled, battery management system (BMS) settings for charging in cycles improve and through safe limitations outside the cells running condition to prevention this reduce. A battery lifetimes lasting besides change expenses in low conventional power system essential to ensure efficiency of power utilization is well for smart grid modern hybrid power system energy optimization. It is beneficial based on intelligent decision-making, the system adaptively and intelligently controls the power, optimizing

battery performance. This results in reduced energy losses, improved power system reliability and efficient utilization of renewable energy sources. The proposed approach supports sustainable energy management and is suitable for modern smart grid applications.

YOLOv8 - Based object detection for real - time video surveillance

Dr. N. Devakirubai,Mr. G. Kannan,G. Archana .
R P Sarathy Institute of technology

Abstract

Video surveillance has become a critical component for ensuring safety and security across public and private environments, including educational institutions, transportation systems, commercial complexes, and smart cities. Nevertheless, conventional surveillance platforms rely on continuous human observation, which limits efficiency, increases operational cost, and makes large-scale real-time analysis error-prone. Although recent deep learning approaches have improved object detection performance, most existing solutions operate in a detection-only mode without effective preservation of object identity, resulting in tracking inconsistencies and reduced situational awareness. This work presents an AI-based real-time object detection and tracking system for intelligent video surveillance that integrates the YOLOv8 deep learning model with the DeepSORT multi-object tracking algorithm. The proposed framework automatically detects, classifies, and tracks multiple objects in live and recorded video streams while maintaining consistent object identities across frames. The solution is entirely software- based and does not require specialized hardware sensors, thereby reducing deployment cost and system complexity. At the core of the framework, YOLOv8—a state-of-the-art single-stage detector—delivers high detection accuracy with low inference latency through enhanced feature extraction and optimized bounding-box regression. To address the limitations of identity-agnostic detection, DeepSORT is incorporated, combining motion prediction using Kalman filtering and appearance-based feature matching for robust object re-identification under crowded scenes, partial occlusions, and viewpoint variations. The system supports user-defined target class selection, enabling flexible surveillance tailored to specific security requirements, and processes video frames using OpenCV. Performance evaluation on the test dataset demonstrates that the framework achieves an accuracy of 97.62%, precision of 97.53%, recall of 99.94%, and an F1-score of 98.72%, while exhibiting improved tracking stability and reduced identity switching under varying lighting and environmental conditions. Compared with traditional monitoring approaches, the proposed system offers enhanced automation, superior tracking consistency, and minimal human intervention. The key contribution of this research lies in the effective integration of advanced detection and identity-preserving tracking into a unified, scalable real- time surveillance solution.

Investigation of jute fibre reinforced composite

P.Santhakumar,G.Velmurugan,Dr.Velmurugan Pavanan.
Excel Engineering College

Abstract

This investigation is dedicated to exploring the promising potential of jute fiber reinforced composite (JFRC) materials within the realm of aircraft construction, driven by the pursuit

of environmentally sustainable and economically viable alternatives to conventional materials. Our inquiry embarks on a multifaceted journey, commencing with an exhaustive literature review that traverses the historical evolution and contemporary trends surrounding JFRC utilization in aviation. Through meticulous examination of case studies and analytical methodologies, we delve into the mechanical intricacies of JFRC, scrutinizing its tensile strength, flexural strength, and fatigue resistance. Moreover, our exploration extends to the nuanced considerations of manufacturing costs, maintenance requirements, and environmental impacts, culminating in a comprehensive assessment of JFRC's suitability for aviation applications. While acknowledging the limited presence of JFRC in commercial aircraft akin to the Boeing 787 Dreamliner, we draw attention to the insightful examples set by smaller general aviation aircraft and experimental models, which have embraced these materials to varying extents. Our overarching objective is to provide a robust understanding of the benefits and challenges associated with JFRC, thereby facilitating informed decision- making processes and propelling the aviation industry towards a more sustainable and economically viable future. Through this endeavor, we endeavor to not only illuminate the pathway towards greener aviation practices but also inspire innovation and collaboration in the pursuit of a more environmentally conscious aerospace landscape.

An AI-Driven Wilderness Search and Rescue (WiSAR) using Thermal Imaging and Autonomous Ground Vehicle

Lokesh Y,Niranjan R,Yogesh C.
Jerusalem college of engineering

Abstract

In India, wilderness search and rescue (WiSAR) operations are often hampered by challenging terrain, low-visibility conditions, and a lack of efficient, real-time detection systems. According to the National Disaster Management Authority (NDMA), India witnesses an average of 50,000 missing person cases annually, with a significant portion occurring in remote or forested areas. Of these, more than 30% remain unresolved for extended periods, highlighting the urgent need for rapid, effective search methodologies. Traditional methods often require several days to locate missing individuals, with a success rate significantly impacted by environmental factors like dense forests, poor weather, and limited human resources. This work proposes an AI-driven system that integrates thermal imaging and acoustic sensing to autonomously locate human presence in such challenging environments. Leveraging a Raspberry Pi as the processing hub, an MLX90640 thermal camera for heat signature detection, and a microphone module for real-time audio anomaly analysis, the system employs lightweight machine learning models to identify human-related anomalies based on thermal and sound data. Research has shown that thermal imaging can reduce search times by up to 40% in low-visibility conditions, while acoustic sensors significantly improve detection of human-generated sounds such as calls for help or movement. The detection outcomes are transmitted to an autonomous ground vehicle (AGV), controlled via an Arduino/ESP32 platform, enabling autonomous navigation through terrain using ultrasonic sensors for obstacle avoidance. Upon detecting an anomaly, the AGV can reorient and approach the source for closer inspection.

EXPERIMENTAL ANALYSIS AND COMPENSATION OF MOTOR INDUCED MAGNETIC INTERFERENCE IN UAVs USING EMBEDDED SYSTEM.

Harisha K,Priyadarshini S,Tamizharasan D.
Jaya engineering College

Abstract

This project proposes a low-cost, lightweight "BLACK BOX" avionics designed to characterize and mitigate Unmanned Aerial Vehicles (UAVs), the electromagnetic interference (EMI) generated by high current propulsion systems of the UAV (brushless DC motors, electronic speed controllers, and power distribution systems) significantly degrades magnetometer measurements, reducing data reliability, which frequently masks subtle the magnetic signals of subsurface mineral deposits. The system utilizes an ARDUINO NANO micro controller integrated with an ACS712 current sensor and a magnetometer. A low-cost magnetometer integrated with a microcontroller platform is used to measure variation in the magnetic field under different motor operating conditions, this system employes an active data logging approach. By recording real-time motor current consumption synchronized with magnetic heading data onto an SD memory module, a mathematical correlation between propulsion load and magnetic deviation can be established. Preliminary bench tests focus on mapping the linear relationship between the current draw of an A2212 brushless motor and the resulting magnetic flux distortion. The results demonstrate that by monitoring current fluctuations, a digital compensation algorithm can effectively reduce "EMI (noise)" from the survey data. This work provides a scalable framework for improving the signal-to-noise ratio in small-scale aeromagnetic surveys, ultimately enhancing the detectability of geomagnetic anomalies for mineral identification.

Effect of cutouts on fuselage section

Hemantha raj M S,Thirunavukarasu S,Kathiravan J.
Jaya engineering College

Abstract

This article deals with the effect of cutouts such as doors and windows on aircraft fuselage structure. Finite element analysis is used to determine stress, buckling load and fatigue life. The fuselage of any aircraft is considered as a curved surface and have multiple cutouts such as doors and windows. The presence of such cut-outs in the fuselage structure causes disturbance in the original stress system, results in an increase in the local stress levels. This study presents a detailed finite element analysis (FEA) of a fuselage-type curved plate segment subjected to mechanical loading conditions. Three CAD models of the curved plate was developed one without any cutout, second with cutout for door and third with cutouts of door and window. All three CAD models discretized using finite element analysis (FEA) tool with shell elements. Material properties corresponding to aerospace-grade aluminum alloy were assigned and relevant boundary conditions were applied to simulate realistic service conditions. The analysis was carried out to evaluate stress distribution, deformation characteristics, and structural performance under static loading. Von Mises stress, total deformation, and strain results were examined to identify critical stress regions and assess structural integrity. The results demonstrates that stress increases whereas load for onset of buckling and fatigue life decreases for fuselage section with doors and windows which is due to sudden discontinuity in geometry which may lead to more stress concentration effect.

Course Recommendation System Using Machine Learning

Deva Dharshini K,Sandhiya M,Suba lakshmi G.
Ramco Institute Of Technology.

Abstract

The increasing complexity of academic course selection, driven by the growing diversity of educational offerings and the persistent misalignment between student competencies and course prerequisites, necessitates the development of intelligent, data-driven advising systems. Traditional course recommendation approaches relying on collaborative filtering or static rule-based models fail to account for multi-dimensional learner profiles and provide no interpretable justification for their outputs, thereby limiting student trust and system transparency. This paper proposes a Machine Learning-Based Course Recommendation System with Explainable AI (XAI) that integrates a three-phase student profiling pipeline with a hybrid classification model to generate personalized, transparent course recommendations. In the first phase, the system performs automated academic profiling by extracting subject-wise marks from PDF marksheets spanning three consecutive semesters using the pdfplumber library, followed by feature engineering to derive cognitive strength indicators including logical thinking, analytical ability, and programming fundamentals. In the second phase, a dynamic programming skill assessment module administers a five- question coding test across multiple languages, classifying learners into beginner, intermediate, or advanced categories using a normalized scoring scheme. In the third phase, student interest areas and career goal inputs are collected to finalize a 19-dimensional feature vector. A hybrid model comprising a Random Forest classifier with 200 estimators and a complementary Decision Tree is trained on a synthetically generated dataset of 3,000 student- course interaction samples encompassing 25 course categories. The Random Forest achieves a cross-validated accuracy of 87.07% ± 0.93% and serves as the primary recommendation engine, while the Decision Tree provides human-interpretable branching logic for each individual decision. The XAI module produces ranked feature contribution scores, natural language justifications, and alternative course suggestions, ensuring full transparency of the recommendation rationale. User profiles and recommendation histories are dynamically persisted in CSV format with role-based access control restricted to an administrator interface. Experimental results demonstrate that the integration of multi-source academic features with explainable decision logic significantly improves both recommendation relevance and user trust compared to black-box baseline approaches, establishing a scalable and interpretable framework for next-generation academic advising systems.

"CROSSWORTHINESS STUDY OF LANDING GEAR USING RUBBER BLOCK ENERGY ABSORBER"

Bhuvanesh R,S R Arun ,Dr.Velmurugan Pavanan .
Excel Engineering College.

Abstract

The rapid advancement in unmanned aerial vehicles (UAVs) has created a demand for efficient, silent, and low maintenance propulsion systems. This project explores the design and study of a UAV integrated with an ionic plasma thruster, a propulsion technology that generates thrust by ionizing a neutral gas and accelerating the ions using electric fields. Unlike conventional propellers, ionic plasma thrusters have no moving parts, produce minimal noise, and offer high energy efficiency. The primary objectives of this study include the design of a miniaturized ion thruster

suitable for UAV integration, understanding the working principles of ion acceleration, and analysing the performance characteristics such as thrust, ion exhaust velocity, and power consumption. A combination of theoretical calculations, performance simulations, and experimental setup with safe laboratory-scale ion thrusters has been employed. Results indicate that while current UAV-scale ionic thrusters produce low thrust (0.05–0.2 g), they can effectively assist conventional propulsion, reduce drag, and enhance aerodynamic stability. The study demonstrates the feasibility of hybrid UAV designs that leverage ionic propulsion for noise reduction, energy efficiency, and flow control. This research lays the groundwork for future high efficiency UAVs, emphasizing the potential

AI-Based Human–Industry Interaction Analysis for Safety Management Using Machine Learning Techniques

Dr. P. Poonkuzhali,Dr. A. Sumaiya Begum,Pavithra P.
R.M.D. Engineering College

Abstract

Industrial environments contain numerous safety hazards due to complex interactions between workers, machines, and surrounding conditions. Traditional safety monitoring systems often rely on manual supervision or rule- based alerts, which may fail to detect subtle risk patterns in real time. This project proposes an AI-based Human–Industry Interaction Analysis system designed to improve workplace safety through intelligent monitoring and predictive risk assessment. The proposed system utilizes machine learning techniques to analyse interactions between human workers and industrial environments. Sensor data, environmental parameters, and worker activity information are collected and processed to identify potential safety risks. By applying data-driven models, the system evaluates multiple factors such as worker proximity to hazardous zones, environmental conditions, and behavioural patterns to generate a dynamic risk score. The developed framework integrates data processing, risk prediction, and visualization modules to provide real-time safety insights. A monitoring dashboard presents risk levels, worker status, and safety alerts, enabling supervisors to respond proactively before accidents occur. The system can also learn from historical data to improve prediction accuracy and support preventive safety strategies. By combining machine learning with industrial safety monitoring, this solution aims to reduce workplace accidents, enhance situational awareness, and support intelligent decision-making in industrial environments. The proposed approach demonstrates how AI-driven analytics can transform traditional safety management systems into proactive and adaptive safety solutions.

Interest-Free Peer-to-Peer Lending

Mohammed Nabeel,Dr Sharmila G.
CMR University

Abstract

Peer-to-peer (P2P) lending platforms allow borrowers and lenders to interact directly through digital systems, improving financial accessibility beyond traditional banking models. However, many existing platforms mainly rely on interest-based repayment structures and predictive credit scoring techniques. While such approaches help estimate financial risk, they do not always enforce strict structural controls within the platform workflow. In this work, a prototype interest-free P2P lending platform is developed to demonstrate preventive control mechanisms within the lending system. The platform includes several safeguards such as a fixed loan exposure cap, borrower wallet

balance locking, administrative verification of loan requests, and automated installment monitoring. The system was implemented as a web-based application using PHP and MySQL. Borrowers can submit loan requests through the platform after maintaining the required wallet balance. Lenders can review approved requests and fund loans using their wallet balance. Repayment is handled through scheduled installments where the principal amount is divided equally across the selected tenure without interest charges. To improve transparency and data integrity, financial transactions are recorded using a SHA-256 hash- linked ledger structure. Each transaction stores a cryptographic hash referencing the previous record, allowing the system to detect any modification in transaction history. The prototype was evaluated through functional testing scenarios including loan validation, repayment monitoring, and ledger integrity verification. The results show that the system successfully enforces borrowing limits, manages repayment conditions, and identifies ledger inconsistencies. These findings demonstrate how architectural control mechanisms can improve transparency and discipline in digital lending platforms.

Real-Time Anomaly Detection in IoMT Networks Using Machine Learning.

Syed Saad Asadulla.
Dr.M.G.R. Educational and Research Institute

Abstract

The Internet of Medical Things (IoMT) has emerged as a transformative paradigm in modern healthcare by interconnecting medical devices, wearable sensors, and healthcare information systems to enable real-time patient monitoring and personalized medical care. While IoMT significantly improves healthcare efficiency, patient outcomes, and service accessibility, its increasing connectivity also exposes healthcare systems to serious cybersecurity threats. Attacks such as data falsification, denial of service (DoS), and other network-based intrusions can compromise data integrity and availability, potentially endangering patient safety and disrupting critical healthcare services. To address these challenges, this study proposes a real-time anomaly detection framework based on machine learning techniques, designed to detect and mitigate diverse cyber threats in IoMT environments. A major contribution of this work is the development of a new healthcare-specific anomaly detection dataset inspired by the UNSW-NB15 benchmark dataset. The proposed dataset is enriched with IoMT-relevant attack scenarios, particularly falsification and DoS attacks, to better reflect real-world healthcare network conditions. The dataset consists of 253,680 records, with 60% representing anomalous activities distributed across multiple attack categories, thereby providing a challenging and realistic environment for evaluating intrusion detection models. Seven machine learning algorithms, including Random Forest, XGBoost, Artificial Neural Networks (ANN), Support Vector Machine, K-Nearest Neighbors, Logistic Regression, and Isolation Forest, were extensively evaluated on both the UNSW-NB15 dataset and the newly developed medical dataset. Based on performance and efficiency analysis, a novel stacking ensemble model was designed, integrating Random Forest and ANN as base learners with XGBoost serving as the meta-learner. This ensemble approach leverages the complementary strengths of individual models to enhance detection accuracy, robustness, and computational efficiency. Experimental results demonstrate that the proposed stacking model significantly outperforms individual machine learning models across key evaluation metrics, including accuracy, precision, recall, and F1-score. Furthermore, a real-time prediction analysis conducted using live data transmission scenarios validates the model's ability to efficiently detect anomalies with minimal latency. These results confirm the effectiveness of the proposed framework for real-time anomaly detection and highlight its suitability for securing IoMT networks against evolving cyber threats.

Real-Time Anomaly Detection in IoMT Networks Using XGBoost and Random Forest

Junayd Shaikh,Moazzam Ahmad.
Crescent Institute of Science and Technology

Abstract

The rapid growth of the medical industry and the increasing use of connected medical devices have led to the emergence of the Internet of Medical Things (IoMT). Hospitals increasingly rely on network-connected equipment for patient monitoring, medical data management, and healthcare operations. However, this increased connectivity also exposes IoMT networks to various cybersecurity threats and intrusion attacks. Therefore, there is a strong need for systems that can effectively detect such attacks in IoMT environments.This project focuses on detecting anomalies and intrusion attacks in IoMT networks using machine learning techniques. The network traffic is analyzed based on the flow of data between devices, which is recorded using attributes such as flow duration, packet size, byte rate, packet rate, and other network-related parameters. These features help identify abnormal behavior within the network traffic.The machine learning model used in this project is trained on approximately 10,000 rows of real-world network traffic data. Algorithms such as Random Forest and XGBoost are implemented to classify normal and malicious network activities. The system allows users to input multiple rows of network data and obtain real-time anomaly detection results along with the predicted attack type. The project is implemented using Python and various machine learning libraries for data processing, model training, and prediction. The proposed system enhances the security and reliability of IoMT networks by providing timely alerts about potential threats, thereby helping protect critical medical devices and healthcare infrastructure.

3D Printing E-Commerce Platform with AI Voice Assistance

KOMMARTHI JOHN,Vishnu E,Vishnu E.
Vels Institute of Science

Abstract

The rapid growth of additive manufacturing has increased the demand for intelligent digital platforms that effectively connect customers with 3D printing services. This project presents the development of a 3D printing e-commerce platform integrated with real-time 3D visualization, AI-based voice assistance, animated product showcases, and secure online payment processing to enhance user interaction and accessibility. The platform allows users to explore 3D printed toys and mechanical components through high-quality rendered models and cinematic animations. Each product is supported with an AI-generated voice description system that automatically narrates product details such as material type, dimensions, usage applications, pricing, and customization options. This feature improves accessibility for visually impaired users and enhances user engagement by providing an interactive shopping experience. A responsive and modern user interface is designed to support seamless performance across multiple devices. Secure payment gateway integration ensures safe and reliable financial transactions while maintaining data privacy and trust. Advanced front-end frameworks and 3D rendering technologies are utilized to deliver photorealistic product presentations, smooth animations, and optimized loading performance. The system architecture is built with scalability in mind, allowing future enhancements such as multilingual voice support,

voice-based product search, real-time order tracking, automated manufacturing updates, and AI-driven product recommendations. This project demonstrates the practical application of artificial intelligence and 3D visualization in digital commerce, creating a smart, efficient, and user-centric platform for modern manufacturing services

AI-Enabled B2B Construction Project Management System

Reena Jenifer R,Maghima Lakshmi A,Dr.E.Padma.
Vels university

Abstract

The construction industry increasingly demands efficient project coordination, accurate requirement analysis, and timely decision-making; however, most existing project management systems rely heavily on manual processes and human expertise. These limitations often result in delays, communication gaps, and reduced operational efficiency. This project proposes an AI- Enabled B2B Construction Project Management System aimed at supporting civil engineers and architects in managing construction projects and client interactions in a more intelligent and automated manner. The proposed system integrates a Large Language Model as an AI-powered professional assistant to interpret client requirements, assist in decision-making, and guide project workflows without employing Retrieval-Augmented Generation. The platform provides functionalities such as client management, AI-based requirement assistance, project planning support, cost and material guidance, and automated reporting within a unified web-based architecture. Modern frontend and backend technologies are employed to ensure scalability, reliability, and seamless interaction between system components. By introducing artificial intelligence into construction project management, the system reduces dependency on manual analysis, minimizes human errors, and enhances productivity and client satisfaction. The proposed approach demonstrates a novel application of AI in B2B construction environments, offering improved efficiency, better resource utilization, and intelligent decision support for real- world construction projects.

Solar Based E-Uniform for Soldiers

Adithya R,Adithya R,Vignesh kumar J.
Jerusalem college of engineering

Abstract

Climate change is difficult to predict in the current state of global scenarios. It is slightly uncomfortable for ordinary people, but it is extremely difficult for soldiers to live in unpredictable climatic conditions. Soldiers risk their lives to protect our country, and this solar-powered climate-adjustable E uniform shields them from harsh weather. Depending on the weather, this uniform provides them with warmth or coolness. This project operates in two modes: summer and winter. Uniforms can drive the body temperature with the Peltier module by selecting the mode of operation. Military uniforms are designed to meet a variety of soldier needs, including environmental protection. Traditional military clothing, on the other hand, may not help control body temperature in adverse weather situations. As a result, this study offers a solar-powered temperature-controlled e-uniform for soldiers to use ton maintain their body temperature in a variety of weather circumstances. A temperature sensor, a microcontroller, a power supply, and heating and cooling devices comprise e-uniform. The temperature sensor measures the soldier's body temperature, and the microcontroller determines whether heating or cooling is required based on the temperature measurements. The e-power uniform's supply will be solar-powered, making it appropriate for usage in rural areas with limited access to energy. Theheating and cooling elements will be triggered

based on the microcontroller's signals. The e- uniform will be lightweight, long-lasting, and comfortable for soldiers.

DESIGN OF LOW MAINTENANCE BEARING FOR AIRCRAFT LANDING GEAR

JAGADEESH J,N.SREENIVASA RAJA,Dr. VELMURUGAN PAVANAN.
Excel engineering college

Abstract

change is difficult to predict in the current state of global scenarios. It is slightly uncomfortable for ordinary people, but it is extremely difficult for soldiers to live in unpredictable climatic conditions. Soldiers risk their lives to protect our country, and this solar- powered climate-adjustable E uniform shields them from harsh weather. Depending on the weather, this uniform provides them with warmth or coolness. This project operates in two modes: summer and winter. Uniforms can drive the body temperature with the Peltier module by selecting the mode of operation. Military uniforms are designed to meet a variety of soldier needs, including environmental protection. Traditional military clothing, on the other hand, may not help control body temperature in adverse weather situations. As a result, this study offers a solar-powered temperature-controlled e-uniform for soldiers to use to maintain their body temperature in a variety of weather circumstances. A temperature sensor, a microcontroller, a power supply, and heating and cooling devices comprise e-uniform. The temperature sensor measures the soldier's body temperature, and the microcontroller determines whether heating or cooling is required based on the temperature measurements. The e-power uniform's supply will be solar-powered, making it appropriate for usage in rural areas with limited access to energy. The heating and cooling elements will be triggered based on the microcontroller's signals. The e- uniform will be lightweight, long-lasting, and comfortable for soldiers.

Keywords: Solar panel, Rechargeable battery, Arduino Uno microcontroller, DHT11 sensor, Peltier module, cooling fan, relay module, ESP01,LCD display.

Solar Based E-Uniform for Soldiers

Adithya R,Bharani Dharan S,Vignesh Kumar j.
Jerusalem College of Engineering.

Abstract

Climate change is difficult to predict in the current state of global scenarios. It is slightly uncomfortable for ordinary people, but it is extremely difficult for soldiers to live in unpredictable climatic conditions. Soldiers risk their lives to protect our country, and this solar-powered climate-adjustable E uniform shields them from harsh weather. Depending on the weather, this uniform provides them with warmth or coolness. This project operates in two modes: summer and winter. Uniforms can drive the body temperature with the Peltier module by selecting the mode of operation. Military uniforms are designed to meet a variety of soldier needs, including environmental protection. Traditional military clothing, on the other hand, may not help control body temperature in adverse weather situations. As a result, this study offers a solar-powered temperature-controlled e-uniform for soldiers to use to maintain their body temperature in a variety of weather circumstances.

A temperature sensor, a microcontroller, a power supply, and heating and cooling devices comprise e-uniform. The temperature sensor measures the soldier's body temperature, and the microcontroller determines whether heating or cooling is required based on the temperature measurements. The e-power uniform's supply will be solar-powered, making it appropriate for usage in rural areas with limited access to energy. The heating and cooling elements will be triggered based on the microcontroller's signals. The e- uniform will be lightweight, long-lasting, and comfortable for soldiers.

SECURE SMART DELIVERY DEVICE: INTELLIGENT PARCEL TRACKING VIA IOT AND AI

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Abstract

The rapid growth of e-commerce and automation-driven logistics has significantly intensified challenges associated with last-mile parcel delivery, particularly in ensuring security, traceability, and delivery authenticity. Conventional delivery systems largely depend on manual verification processes, static tracking mechanisms, and single-factor authentication, which are increasingly inadequate for addressing modern threats such as package theft, unauthorized access, misdelivery, and environmental damage during transit. To overcome these limitations, this paper presents the Secure Smart Delivery Device: Intelligent Parcel Tracking via IoT and AI, a system that integrates Internet of Things (IoT) technologies, edge- based artificial intelligence, and multi-factor authentication to provide a secure, intelligent, and autonomous parcel delivery solution. The proposed system employs a context-aware Zero Trust security framework that verifies every delivery attempt instead of assuming trust by default. Access to the delivery device is granted only when three independent authentication layers are successfully validated: (i) GPS-based geo-fencing, ensuring the device is located within a predefined delivery zone; (ii) AI-based facial recognition with liveness detection, enabling robust biometric authentication under varying environmental conditions; and (iii) One-Time Password (OTP) verification,
securely transmitted via GSM to the registered recipient. The system is built around a Raspberry Pi 4 as the central processing unit, integrated with a Neo-6M GPS module, SIM800L GSM module, Pi Camera, and multiple environmental and tamper-detection sensors including vibration, magnetic, temperature, and humidity sensors. All authentication and decision-making processes are executed at the edge device, which reduces latency, enhances privacy protection, and eliminates dependency on continuous cloud connectivity. Real-time monitoring and encrypted communication enable both senders and recipients to track parcel status, receive alerts, and verify delivery integrity throughout the logistics lifecycle. Experimental evaluation demonstrates strong system performance, achieving 98.4% overall authentication accuracy, 97.9% precision, 98.3% recall, and an average end-to-end response latency of 1.4–1.6 seconds, confirming the system's suitability for real-time deployment. The false positive rate remained below 2%, indicating reliable performance in detecting unauthorized access and tampering under real-world conditions. The results confirm that combining AI-based biometric verification, IoT-enabled sensing, and geo-fencing within a multi-layer authentication framework significantly enhances last-mile delivery security and operational efficiency. The Secure Smart Delivery Device: Intelligent Parcel Tracking via IoT and AI offers a scalable, tamper-resistant, and intelligent solution for modern logistics systems, smart parcel lockers, and autonomous delivery infrastructures, paving the way for next-generation secure parcel delivery networks.

Investigation of the Mechanical Properties of a Magnesium Metal Matrix Composite Reinforcement with Boron Carbide

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Abstract

Magnesium metal matrix composites (MMCs) have gained significant attention in recent years due to their lightweight nature and superior specific mechanical properties. The present work will be investigating the mechanical properties of a magnesium-based metal matrix composite reinforced with Boron carbide (B 4 C) particles. AZ91 Magnesium alloy will be selected as the base material owing to its low density, good machinability and good castability, while boron carbide will be selected as reinforcement due to its extremely high hardness and low density. The composite will be fabricated using the stir casting technique with varying weight percentages of B 4 C to ensure uniform particle distribution. Mechanical characteristics will be carried out through tensile strength, hardness, and impact tests to evaluate the effect of reinforcement addition on the composite performance.

Next Gen-AI Code Debugger and Explainer for Multi-programming Language

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Abstract

A Next Gen-AI Code Debugger & Explainer for multi-programming languages, targeting the shortcomings of conventional code debuggers and the privacy issues related to cloud-based Al assistants. The proposed system integrates a hybrid framework that leverages a dual-processing paradigm: Google Gemini for high-parameter cloud reasoning and Code LLaMA/Gemma through Ollama for localized, privacy-preserving processing. The engine supports automatic multi-layer diagnostics, going beyond conventional syntax analysis to engage in deep-level repair of runtime errors and logical discrepancies. To fill the "conceptual gap" for newbies, the system includes human-centric pedagogical translation, rendering opaque technical metadata in natural language form. By focusing on an offline mode, the framework guarantees data residency and security, precluding the leakage of proprietary information while sustaining low-latency performance even in zero-connectivity settings. The proposed system, developed with the StreamLit framework, integrates code generation, debugging, and explanation within a single, interactive dashboard, providing a scalable and future-proof platform for contemporary software development.

An Effective Approach For Securing Data Transmission Using Novel Homomorphic Encryption Algorithm in Comparison of Elliptic Curve Cryptography based on Encryption Time

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Abstract

The increasing complexity of academic course selection, driven by the growing diversity of educational offerings and the persistent misalignment between student competencies and course prerequisites, necessitates the development of intelligent, data-driven advising systems.

Traditional course recommendation approaches relying on collaborative filtering or static rule-based models fail to account for multi-dimensional learner profiles and provide no interpretable justification for their outputs, thereby limiting student trust and system transparency. This paper proposes a Machine Learning-Based Course Recommendation System with Explainable AI (XAI) that integrates a three-phase student profiling pipeline with a hybrid classification model to generate personalized, transparent course recommendations. In the first phase, the system performs automated academic profiling by extracting subject-wise marks from PDF marksheets spanning three consecutive semesters using the pdfplumber library, followed by feature engineering to derive cognitive strength indicators including logical thinking, analytical ability, and programming fundamentals. I the second phase, a dynamic programming skill assessment module administers a five- question coding test across multiple languages, classifying learners into beginner, intermediate, or advanced categories using a normalized scoring scheme. In the third phase, student interest areas and career goal inputs are collected to finalize a 19-dimensional feature vector. A hybrid model comprising a Random Forest classifier with 200 estimators and a complementary Decision Tree is trained on a synthetically generated dataset of 3,000 student- course interaction samples encompassing 25 course categories. The Random Forest achieves a cross-validated accuracy of 87.07% ± 0.93% and serves as the primary recommendation engine, while the Decision Tree provides human-interpretable branching logic for each individual decision. The XAI module produces ranked feature contribution scores, natural language justifications, and alternative course suggestions, ensuring full transparency of the recommendation rationale. User profiles and recommendation histories are dynamically persisted in CSV format with role-based access control restricted to an administrator interface. Experimental results demonstrate that the integration of multi-source academic features with explainable decision logic significantly improves both recommendation relevance and user trust compared to black-box baseline approaches, establishing a scalable and interpretable framework for next-generation academic advising systems.

Quantifying Expressive Coherence: A Multimodal Edge - Computing Framework for Automated Interview Assessment.

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Abstract

Despite having strong technical expertise, many engineering graduates are rejected during job interviews because they lack soft skills and effective communication. Conventional training techniques, like human-led mock interviews, are difficult to scale across large institutions, subjective by nature, and vulnerable to evaluator bias. Furthermore, the intricate subtleties of human interaction are often overlooked by current AI tools, which usually analyze speech or video in isolation. In order to close this gap, a novel edge-computing framework that offers automated, unbiased feedback on a student's interview performance is presented in this paper. To protect user privacy and minimize network latency, our system records synchronized audio and video feeds and processes them completely offline. It tracks posture, eye contact, and facial micro-expressions using computer vision techniques, namely MediaPipe and DeepFace. It simultaneously uses Librosa's audio signal processing to assess speech rate, loudness, and vocal pitch. The quantification of "Expressive Coherence," a decision-level fusion metric that assesses the psychological alignment between a candidate's vocal tone and facial affect, is the main innovation of this study. This enables the AI to identify hidden inconsistencies, like when a candidate tries to smile confidently while their voice trembles with nervousness. By mapping these fused

multimodal insights against the standardized Public Speaking Competence Rubric (PSCR), the system delivers non-intrusive, real-time corrective nudges in under 200 milliseconds, followed by a comprehensive post-session scorecard. Ultimately, this framework serves as an impartial virtual mentor, offering students a stress-free, scalable environment to iteratively refine their behavioural skills before facing real recruiters.

Intelligent Code Quality Assessment and Automated Test Case Generation Using AI

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Abstract

Software testing and code quality evaluation are crucial stages in the Software Development Life Cycle (SDLC) to guarantee the dependability, maintainability, and performance of software systems. Conventional testing methods primarily rely on multiple independent tools for quality assessment and bug detection, as well as manual code reviews.

These techniques are frequently time-consuming and make it challenging for developers to find modules that are prone to errors and assess the code's structural quality. This project suggests an AI-Based Automated Software Testing and Code Quality Evaluation System that incorporates intelligent analysis methods to enhance software dependability and testing effectiveness in order to get around these restrictions. In order to comprehend the program structure, the suggested system automatically preprocesses and examines the source code. It uses Static Code Analysis (SCA) and Abstract Syntax Tree (AST) parsing to extract crucial software metrics like Function Count, Lines of Code (LOC), and Cyclomatic Complexity (CC). These metrics are used to predict defect-prone modules using machine learning algorithms such as Random Forest, Decision Tree, and Logistic Regression. These models help developers concentrate on high- risk software components by analyzing patterns within the codebase and estimating the likelihood of defects.

The system not only predicts defects, but it also uses metrics like Cyclomatic Complexity and Maintainability Index (MI) to rate the quality of the code. Control Flow Analysis (CFA) and Boundary Value Analysis (BVA) are used to make sure that the right paths are covered by the automated test cases. An interactive dashboard shows the results, such as found bugs, quality scores, and created test cases, in a way that is easy to understand and see.

AI-Based Power Switching System Between Renewable Energy and Grid Power with a Real-Time Web Dashboard Using Raspberry Pi

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Abstract

The rapid increase in global energy demand and the growing need for sustainable energy solutions have accelerated the integration of renewable energy sources into modern power systems. Solar photovoltaic (PV) energy has emerged as one of the most promising renewable sources due to its availability, environmental benefits, and cost effectiveness. However, the intermittent nature of solar energy presents significant challenges in maintaining a stable and continuous power supply. Traditional power management systems typically rely on manual switching or simple threshold-based controllers to alternate between renewable sources and grid power. These methods are often inefficient, unable to adapt to changing environmental conditions, and may lead to unnecessary

dependence on grid electricity. This project proposes an AI-Based Power Switching System between Renewable Energy and Grid Power with a Real-Time Web Dashboard using Raspberry Pi. The objective of the system is to intelligently manage energy sources by automatically selecting the most efficient power supply based on real-time operating conditions. The proposed system integrates renewable energy monitoring, artificial intelligence, and Internet of Things (IoT) technologies to provide a smart and adaptive energy management solution. The system utilizes a Raspberry Pi as the central controller to collect real-time data from voltage and current sensors connected to a solar photovoltaic panel and the electrical load. These sensors continuously monitor parameters such as solar voltage, solar current, and load demand. The collected data is then processed using machine learning algorithms, specifically Decision Tree and Random Forest models, which analyze the energy conditions and predict the optimal power source. In addition, the system incorporates weather forecast data obtained through an API to improve prediction accuracy and anticipate fluctuations in solar energy generation. Based on the output of the AI model, the Raspberry Pi controls a relay-based switching mechanism that automatically connects the load either to the solar PV system or to the utility grid. When sufficient solar energy is available, the system prioritizes renewable energy usage. If solar generation decreases due to environmental conditions or increased load demand, the system seamlessly switches to grid power to ensure uninterrupted electricity supply. The switching process occurs within milliseconds, ensuring reliability and stability for residential or institutional loads. To enhance user interaction and monitoring capabilities, the system also features a web-based IoT dashboard developed using the Flask framework. The dashboard allows users to remotely monitor key parameters such as solar voltage, load consumption, grid usage, and switching status in real time. Historical data visualization enables users to analyze energy usage patterns and make informed decisions about energy consumption. Integration with cloud platforms further allows remote accessibility and data storage. Experimental evaluation of the prototype demonstrates high system performance with switching efficiency exceeding 99.5% and prediction accuracy of approximately 95% using the Random Forest model. The system also contributes to significant energy cost savings by prioritizing renewable energy usage, potentially reducing electricity expenses by 15–20% compared to conventional manual or threshold-based switching methods. Overall, the proposed system provides a low-cost, intelligent, and scalable energy management solution suitable for homes, educational institutions, and small-scale facilities. By combining artificial intelligence, IoT-based monitoring, and renewable energy integration, the system promotes efficient power utilization, reduces dependence on conventional grid electricity, and supports the development of sustainable smart energy systems.

A Decentralized Blockchain Framework For Secure Product Verification And Tracking

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Abstract

Global supply chains that contain counterfeit goods put consumer safety, brand reputation, and economic stability at serious risk. Barcodes, centralised databases, and manual verification procedures are the mainstays of traditional product authentication techniques. These methods lack end-to-end transparency across supply chain networks and are susceptible to duplication and data manipulation. In order to enhance product authenticity, transparency, and traceability in supply chain settings, this paper suggests a Blockchain- Based Fake Product Identification and Supply Chain Tracking System that incorporates decentralised technology. To guarantee immutability and tamper-resistant record keeping, the suggestedsolution safely registers product information on a blockchain network. A distinct QR code containing a safe link to data stored on the blockchain is given to every product. Important supply chain processes including product registration, ownership

transfer, and verification are automated via smart contracts. A transparent and verifiable transaction history is created by stakeholders, such as manufacturers, distributors, and retailers, updating product movement data on the blockchain. Customers can use a web or mobile application to scan the QR code and instantly confirm the authenticity of products, in addition to tracking the supply chain. To ascertain whether the goods is authentic or fake, the scanned data is verified against blockchain records. The technology increases supply chain partners' trust, improves traceability, and stops the spread of counterfeit goods by fusing blockchain security with effective off-chain data management.

Reward-Based Erudition Platform Powered by Artificial Intelligence

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Abstract

Online learning platforms have greatly helped learners access learning resources. However, learners still face difficulties when it comes to selecting appropriate learning courses. Most e-learning systems currently used by learners apply common recommendation strategies that are not effective in properly evaluating learners' abilities. This has led to learners being offered courses that are not appropriate for their abilities, resulting in poor learning results. This paper proposes a Reward-Based Erudition Platform that uses adaptive evaluation and machine learning algorithms to recommend appropriate learning courses for learners. The Reward-Based Erudition Platform evaluates learners' abilities using profiling questions and a diagnostic quiz. Learners' performance metrics such as accuracy, response time, and answer consistency are then used to compute a reward score that represents learners' abilities. The learners' metrics are then used by machine learning algorithms such as Decision Tree, Random Forest, and K-Nearest Neighbors to recommend appropriate courses for learners. In this framework, the reward is represented by the course recommended to learners. After learners complete their course, an assessment is carried out to determine the effectiveness of the course recommendation. The results obtained showed that the proposed hybrid recommendation method improves learners' engagement and recommendation accuracy compared to existing course recommendation systems.

Machine Learning Based Morphological Classification Of Microscopic Organisms

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Abstract

The identification of microscopic organisms is central to microbiological analysis, clinical diagnostics, and environmental surveillance. Conventional identification procedures depend largely on manual microscopic inspection, which is inherently time-intensive and susceptible to observer variability. With the rapid advancement of computational intelligence, automated image-based classification systems have emerged as viable alternatives. This study presents a deep learning-based framework for morphological recognition of microscopic organisms. The proposed system

integrates structured image preprocessing, data augmentation, and transfer learning using convolutional neural networks to extract biologically meaningful features directly from microscopic images. The classification model achieves an overall accuracy of 90%, demonstrating strong discrimination capability even among morphologically similar organisms. In addition to performance evaluation, the paper discusses dataset limitations, generalization challenges, and interpretability considerations. The results affirm the effectiveness of machine learning in improving reliability and scalability in automated biological image analysis. Keywords - Microscopic Organisms, Morphological Classification, Deep Learning, Transfer Learning, Biomedical Image Analysis, CNN.

A smart environmetal paramter sensing system

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Abstract

Environmental monitoring is essential for ensuring human safety, particularly in industrial, outdoor, and polluted environments where exposure to harmful gases and unfavorable conditions can affect health. Conventional environmental monitoring systems are typically stationary, expensive, and unsuitable for real-time personal monitoring. This paper presents the design and implementation of an Ambient Band, a compact and portable environmental monitoring system capable of measuring temperature, air quality, and atmospheric pressure in real time. The proposed system uses an ESP8266 microcontroller as the core processing unit, integrated with a BME280 sensor for temperature and pressure measurement and an MQ135 gas sensor for air quality detection. The collected data is processed and displayed on an LCD screen to provide immediate feedback to the user. The system is designed with low power consumption, compact size, and reliable performance, making it suitable for continuous operation. Experimental results demonstrate that the system provides accurate and stable environmental measurements under different conditions. The Ambient Band offers a cost- effective and efficient solution for personal environmental monitoring, industrial safety, and smart city applications, with the potential for future integration with wireless networks.

IOT BASED SMART VEHICLE ACCIDENT DETECTION USING MULTIPLE SENSORS

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Abstract

Road traffic accidents remain a major global public safety issue, resulting in millions of fatalities and severe injuries annually. A significant proportion of these fatalities occur due to delayed medical intervention and lack of immediate accident detection mechanisms. Conventional accident reporting systems depend on manual communication or limited single-parameter detection techniques, which are unreliable in cases where the driver becomes unconscious or the accident occurs in remote areas. This paper presents a multi-sensor IoT-based intelligent vehicle accident detection and emergency response system implemented using the ESP32 microcontroller. The proposed system integrates an MPU6050 accelerometer and gyroscope module for motion and orientation analysis, a vibration sensor for impact detection, a sound sensor for identifying abnormal acoustic spikes, and an MQ- 2 gas sensor for detecting fire hazards after collision. A multi- sensor fusion algorithm is developed to validate accident conditions by correlating multiple physical parameters, thereby minimizing false positives caused by road irregularities or sudden braking.

Additionally, a driver verification delay mechanism is incorporated to prevent unintended emergency triggering. Simulation results demonstrate low latency (<200 ms), stable performance, and improved detection reliability compared to single-sensor approaches. The proposed system provides a cost-effective, scalable, and energy-efficient solution suitable for real-time automotive safety applications and intelligent transportation systems.

3D Printing E-Commerce Platform with AI Voice Assistance

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Abstract

The rapid growth of additive manufacturing has increased the demand for intelligent digital platforms that effectively connect customers with 3D printing services. This project presents the development of a 3D printing e-commerce platform integrated with real-time 3D visualization, AI-based voice assistance, animated product showcases, and secure online payment processing to enhance user interaction and accessibility. The platform allows users to explore 3D printed toys and mechanical components through high-quality rendered models and cinematic animations. Each product is supported with an AI-generated voice description system that automatically narrates product details such as material type, dimensions, usage applications, pricing, and customization options. This feature improves accessibility for visually impaired users and enhances user engagement by providing an interactive shopping experience. A responsive and modern user interface is designed to support seamless performance across multiple devices. Secure payment gateway integration ensures safe and reliable financial transactions while maintaining data privacy and trust. Advanced front-end frameworks and 3D rendering technologies are utilized to deliver photorealistic product presentations, smooth animations, and optimized loading performance. The system architecture is built with scalability in mind, allowing future enhancements such as multilingual voice support, voice-based product search, real-time order tracking, automated manufacturing updates, and AI-driven product recommendations. This project demonstrates the practical application of artificial intelligence and 3D visualization in digital commerce, creating a smart, efficient, and user-centric platform for modern manufacturing services

Taskora - – A Cloud-Native Enterprise Collaboration System with Generative AI for Intelligent Work Execution

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Abstract

Modern organizations increasingly rely on digital collaboration platforms to coordinate tasks, manage workflows, and support distributed teams. However, many existing enterprise collaboration tools primarily focus on task tracking and communication, offering limited intelligent support for work execution and decision-making. This limitation often leads to inefficient task planning, lack of visibility into dependencies, and increased manual effort in managing project workflows. To address these challenges, this paper presents Taskora, a cloud- native enterprise collaboration system enhanced with Generative Artificial Intelligence (AI) to facilitate intelligent work execution and team coordination. Taskora is designed to integrate advanced cloud computing

capabilities with AI-driven insights to provide a scalable and efficient platform for enterprise collaboration. The system architecture follows a modular design consisting of a React-based frontend interface, a backend application server with API gateway integration, a Generative AI processing layer, and a cloud deployment environment. The frontend module provides a user-friendly interface for task creation, monitoring, and workflow visualization, allowing users to interact with the system through dashboards and natural language inputs. The backend platform manages core system logic, including task lifecycle management, workflow coordination, and role-based access control (RBAC), ensuring secure access and controlled interaction among users. A key feature of the proposed system is the integration of Generative AI for intelligent task processing. Through natural language processing techniques, the system interprets user-provided task descriptions and converts them into structured and actionable workflows. The AI module assists in task decomposition, priority suggestion, dependency identification, and automation recommendations, thereby reducing the manual workload associated with planning and coordination. This capability allows organizations to transition from traditional manual task management toward an intelligent and automated execution environment. In addition to AI-driven functionality, Taskora incorporates real-time collaboration features using event-driven communication mechanisms such as WebSockets. These capabilities enable instant synchronization of task updates, notifications, and collaborative interactions among team members. Real-time visibility into task progress and system activities helps improve coordination, reduce delays, and ensure that team members remain informed about ongoing developments within projects.

Adaptive Human-AI Collaborative Digital Twin for Intelligent Robotic Arm Optimization in Industry 5.0

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Abstract

This research proposes an intelligent Cognitive Digital Twin–based predictive maintenance framework designed to improve reliability, efficiency, and human–machine collaboration in advanced robotic systems aligned with Industry 5.0 principles. The framework is implemented for the UR5 Robot Arm in a simulated industrial environment to demonstrate how Digital Twin technology enhances operational awareness and maintenance efficiency. The system creates a Digital Twin that mirrors the operational state of the robotic system using real-time data streams. A sensor simulation module generates industrial parameters such as air temperature, process temperature, rotational speed, torque, and tool wear, which emulate real machine sensor outputs. These data are continuously transmitted to a predictive analytics layer where both traditional machine learning models and artificial neural networks are applied using scikit-learn and TensorFlow. While algorithms such as Random Forest and Logistic Regression capture structured relationships within the data, the neural network model(LSTM) learns complex nonlinear patterns, enabling more accurate detection of subtle anomalies that may indicate early mechanical failures. To ensure transparency and trust in artificial intelligence predictions, the framework incorporates explainable AI techniques using SHAP (SHapley Additive exPlanations), which highlights how each sensor parameter contributes to predicted failure risk. The architecture also introduces a cognitive human-in-the-loop decision layer where operators can review AI recommendations and accept or override them, enabling effective human-AI collaboration in Industry 5.0 environments. Additionally, a meta-learning mechanism dynamically adjusts risk thresholds based on operational feedback, allowing the model to adapt to changing machine conditions and improve prediction accuracy over time. The system provides an

interactive monitoring interface developed using Flask with real-time data streaming through Flask-SocketIO, while a three-dimensional digital twin visualization built with Three.js displays the robotic system with color-coded health indicators. Experimental evaluation shows that the hybrid predictive model achieves approximately 94% prediction accuracy, reduces false alarms by 18%, improves operator response time by 21%, and lowers simulated operational downtime by 15%. Overall, the framework demonstrates how Digital Twin technology, neural network–enhanced predictive analytics, explainable AI, and human-centric decision systems can support the development of intelligent, resilient, and sustainable industrial maintenance platforms for next-generation manufacturing systems.

Interactive AI Face Generator For Criminal Investigation

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Abstract

Criminal investigations frequently rely on eyewitness descriptions to identify culprits. Traditionally, forensic artists draw sketches based on witness testimony, which can be time-consuming and rely heavily on the artist's skill and interpretation. To address these limitations, this project presents an Interactive AI Face Generator for Criminal Investigation, which employs artificial intelligence to generate suspect facial images based on descriptions provided by investigators or witnesses. Users can input many facial parameters such as age, gender, ethnicity, eye color, nose shape, lip fullness, hair type, skin tone, and facial structure via an interactive interface. These attributes are gathered via a face feature input form and processed by a backend system built with FastAPI. The organized facial features are converted into a precise natural language description by the system's prompt generation mechanism. The resulting prompt is fed into a Stable Diffusion text-to-image model, which generates a realistic facial image based on the input description. The system's architecture is made up of many functional modules, such as the Facial Features Input Module, Prompt Generation Module, AI Image Generation Module, and Database Storage Module. These modules work together to quickly handle user input and create a facial composite image. The generated photos and associated feature data can be saved in a database for future research and analysis. The suggested system considerably decreases the dependency on manual sketching while improving the speed and consistency of suspect face generation by utilizing modern generative artificial intelligence and deep learning techniques. This technology can help law enforcement organizations immediately visualize suspects based on witness descriptions, increasing the efficiency of criminal investigations. The research exhibits the practical application of text-to- image generative models in forensic and investigative disciplines, providing an intelligent and interactive method to automated suspect face production.

Harnessing Data Analytics for Enhanced Decision-Making

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Abstract

In the modern digital landscape, enterprises c montinuously generate massive volumes of information; however, extracting actionable intelligence remains a challenge due to the constraints of legacy processing systems. Conventional business strategies rely heavily on isolated, historical data analysis, which often struggles with scalability, is highly susceptible to human error, and fails to adapt to sudden market fluctuations. To overcome these limitations, this research introduces a novel framework termed Optimized Decision- Making using Big Data Analytics (ODM-BDA). Designed to fortify organizational strategy, this system actively gathers both structured and unstructured inputs from diverse business nodes, seamlessly processing them through scalable distributed architectures. By integrating machine learning algorithms—specifically Random Forest, K-Means Clustering, and Logistic Regression—the platform accurately forecasts consumer trends and operational shifts. A key technical advancement of this model is the incorporation of a "Backtracking-Based Risk Management" protocol. This unique fail- safe mechanism continuously evaluates the alignment of AI-generated predictions against predefined corporate risk tolerances, autonomously reverting to a previous secure operational state if a strategic pathway proves highly risky or erroneous. Concurrently, steep optimization methods are deployed to drastically accelerate predictive model training and efficiently manage high-velocity financial data streams. By synthesizing these elements into a unified decision support dashboard, the ODM-BDA framework functions as a resilient, real-time advisory tool. It empowers organizations to test and refine critical business maneuvers in a highly secure, data-driven environment, ultimately minimizing uncertainty and maximizing strategic agility.

IoT-Based Solar–Grid Hybrid Energy Management with Real-Time Monitoring and Machine Learning

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Abstract

The increased world energy demand and the increasing environmental issues have brought the necessity to focus on efficient renewable energy. The solar energy is an efficient and clean alternative that can be considered, but due to its intermittence, it requires clever management. The given project suggests an IoT-based solar-grid hybrid energy management system, which cannot be full of grid power when solar energy is not sufficient to provide the power but serves as a backup during the times of full loads or low power generation. The ESP32 microcontroller measures voltage, current, load and solar output in real-time to allow automatic switching of the supply to a power supply through a relay mechanism. The information is sent to ThingSpeak to store it on the cloud and to MATLAB, to perform machine learning analysis. A Decision Tree model predicts in energy demand and in the availability of solar which augments efficiency of switching. The system makes it more dependable, less grid reliant and contributes to the optimal usage of the energy based on the data- driven decision making.

AI-POWERED RESOURCE AND SUBSIDY ALLOCATION FOR FARMERS WITH BLOCKCHAIN TRANCPARENCY

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Abstract

Agriculture plays an important role in the economy and provides livelihood for a large number of farmers. Governments provide agricultural subsidies to support farmers, improve productivity, and ensure food security. However, the current subsidy distribution systems face several challenges such as manual verification, lack of transparency, delays in fund allocation, and the possibility of fraudulent claims. These issues often prevent subsidies from reaching the farmers who genuinely need support.To overcome these problems, this paper proposes a transparent and efficient agricultural subsidy allocation framework that combines data analysis and blockchain technology. In the proposed system, farmer information such as land details, crop type, income level, and previous subsidy records are collected and verified through a digital platform. The data is then processed using the XGBoost algorithm, which helps in predicting the eligibility of farmers and determining the appropriate subsidy allocation based on predefined criteria. This approach helps in identifying deserving beneficiaries in a more systematic and accurate manner.The system also uses blockchain technology to maintain a secure and tamper-proof record of subsidy decisions and transactions. Smart contracts are used to automatically process and release subsidy funds once eligibility conditions are satisfied. Because blockchain records cannot be altered easily, it ensures transparency and prevents unauthorized changes to the data. All transactions related to subsidy allocation are recorded in a distributed ledger, which can be accessed and verified by authorized stakeholders.The proposed framework aims to reduce corruption, minimize human intervention, and improve the efficiency of subsidy distribution. By automating the verification and allocation process, the system helps reduce processing time and ensures that financial assistance reaches farmers more quickly. In addition, the use of data-driven decision making improves fairness and accuracy in identifying eligible beneficiaries.Overall, this approach provides a reliable and transparent solution for agricultural subsidy management. The of data analysis and blockchain technology can improve integration accountability, enhance trust between farmers and government agencies, and support better policy implementation. The proposed system can also be expanded in the future to include additional agricultural support services and large-scale government welfare programs.

Friction Stir Welding of AA2014-AA8011: Multi-objective Optimisation of Process Parameters Using TOPSIS Approach

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Abstract

In this study, multi objective optimization for Friction stir welding (FSW) of dissimilar AA2014-AA8011 has been presented to provide optimum tensile strength, hardness and Impact Strength. The study takes into account the tool rotational speed, feed, and tilt angle as input parameters. Experiments are designed based on Taguchi L 9 orthogonal
array. Measurements of the welded joints' tensile strength, hardness, and impact strength are used to examine the impact of FSW utilising these welding parameters. The main effects plot and interaction plot were used to discuss the parametric influence on responses. Additionally, Technique for order of preference by similarity to ideal solution (TOPSIS) was used to carry out multi-objective optimization. The tilt angle was shown to be the most important factor influencing the responses, followed by the tool rotational speed and feed according to the results. The obtained optimum combinations of parameters are i.e. tool rotational speed 710 rpm, feed 40 mm/rev, and tilt angle 1 o .

Keywords: Tensile strength, hardness, FSW, orthogonal array, multi response optimization.

INSTAGRAM REACH RADAR: AN AI FRAMEWORK FOR ENGAGEMENT PREDICTION

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Abstract

The exponential growth of social media platforms has transformed Instagram into a critical medium for digital marketing and online branding. However, existing analytics tools primarily provide descriptive statistics without predictive intelligence or automated content optimization capabilities. This paper presents Instagram Reach Radar, an AI-driven analytics framework designed to predict post reach and enhance engagement using machine learning, natural language processing, and deep learning techniques. The proposed system integrates Random Forest–based regression and classification models to forecast impressions and categorize post performance. A novel metric termed Tagging Effectiveness Score (TES) is introduced to evaluate the contribution of hashtags to post reach. Additionally, a BLIP-based vision-language model is incorporated to generate automated captions from uploaded images. Experimental evaluation using structured Instagram datasets demonstrates strong predictive performance, achieving high accuracy and reliable classification results. The framework combines intelligent detection, visualization, and recommendation mechanisms to support data-driven content optimization. By unifying predictive analytics and creative AI, Instagram Reach Radar offers a scalable and adaptive solution for modern social media performance analysis.

A Comparative Study of GLCM Texture Features, MobileNetV2 Deep Features, and Hybrid Fusion for Tomato Leaf Disease Detection

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Abstract

Early detection of plant diseases is essential for improving crop productivity and supporting sustainable agricultural development. Among various crops, tomato plants are highly susceptible to a wide range of leaf diseases that significantly reduce yield and quality if not identified at an early stage. Manual disease identification by farmers or agricultural experts is often time-consuming, subjective, and requires domain expertise. Therefore, the disease detection systems based on image processing and machine learning techniques have gained considerable attention in precision agriculture. This research presents a structured comparative analysis of three classification frameworks for the detection of tomato leaf diseases using ensemble machine learning classifiers, namely Random Forest, XGBoost, and LightGBM. The study considers ten classes, including nine common tomato leaf diseases—Bacterial Spot, Early Blight, Late Blight, Leaf Mold, Septoria Leaf Spot, Spider Mites, Target Spot, Tomato Mosaic Virus, and Yellow Leaf Curl Virus—along with healthy leaves. In all three proposed methods, the input RGB leaf image first undergoes a preprocessing stage where it is converted into a grayscale image and enhanced using Contrast Limited Adaptive Histogram Equalization (CLAHE). This preprocessing step improves image contrast and highlights important disease patterns present on the leaf surface. In the first method, texture-based analysis is performed by extracting statistical features such as contrast, correlation, energy, and homogeneity using the Gray Level Co-occurrence Matrix (GLCM). The extracted feature vectors are

then classified using Random Forest, XGBoost, and LightGBM classifiers, achieving a maximum classification accuracy of 92%. In the second method, instead of handcrafted texture feature extraction, deep features are obtained directly from the preprocessed images using a pretrained MobileNetV2 convolutional neural network. These deep representations capture more complex and discriminative patterns related to disease characteristics. The extracted deep features are subsequently classified using the same ensemble classifiers, resulting in an improved classification accuracy of 94%. To further enhance the classification performance, the third method introduces a hybrid feature fusion strategy that combines the GLCM texture features from the first method with the deep features extracted from MobileNetV2 in the second method. This fusion produces a comprehensive feature representation that integrates both low-level texture information and high-level semantic features of the leaf image. The fused feature set is evaluated using Random Forest, XGBoost, and LightGBM classifiers, where the optimal classifier achieves the highest classification accuracy of 95%, outperforming the individual feature extraction approaches. Additionally, the proposed system generates a normalized probability distribution across all classes to indicate prediction confidence for each detected disease category. Experimental results demonstrate that the hybrid feature fusion framework provides superior accuracy, robustness, and reliability compared to standalone feature extraction methods. The proposed approach can therefore serve as an effective intelligent decision-support tool for tomato disease detection, assisting farmers in early diagnosis and enabling timely crop management in precision agriculture system.

Keywords
Tomato Leaf Disease Detection, Gray Level Co-occurrence Matrix (GLCM), MobileNetV2, Hybrid Feature Fusion, Ensemble Learning, Random Forest, XGBoost; LightGBM, Precision Agriculture.

Multimodal Transformer Based Healthcare Symptom Analysis Using Whisper Speech Recognition and Llama 3 Vision Model

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Abstract

The rapid advancement of Artificial Intelligence (AI) technologies has significantly transformed the healthcare sector by enabling the development of intelligent support systems capable of assisting users in obtaining preliminary medical guidance. With the increasing demand for accessible healthcare information, AI-powered medical assistants have become an important tool for improving health awareness and early symptom identification. However, most existing healthcare chatbots are limited to single-modal interaction, typically relying only on text-based communication. These systems often lack the ability to simultaneously process multiple input modalities such as voice, text, and medical images, and they also provide limited support for multilingual communication. As a result, users from diverse linguistic backgrounds and individuals with limited technical literacy may face difficulties in accessing healthcare information effectively to overcome these limitations, this paper proposes Curavox, a multimodal AI-
powered healthcare assistant designed to analyse and interpret symptoms using voice, text, and image inputs while supporting multilingual interaction. The proposed system follows a structured algorithmic workflow that includes input acquisition, pre-processing, multimodal data analysis, and intelligent response generation. Initially, user voice queries are processed through a Speech-to-Text

(STT) algorithm based on the Whisper speech recognition model, which accurately converts spoken language into textual form while supporting multiple languages. The processed text, along with uploaded medical images provided by the user, is then analysed using the Llama-3 Vision multimodal large language model. This model enables contextual understanding of both textual descriptions and visual medical information, thereby improving the system's ability to interpret symptoms and provide relevant guidance to ensure efficient and high-speed model inference, the system integrates the Groq API, which optimizes the execution of large language models and accelerates response generation. The generated output is subsequently transformed into natural speech using a multilingual Text-to-Speech (TTS) synthesis model, allowing users to receive responses in a human-like conversational format across different languages. The entire system is implemented using Python-based technologies and the Gradio framework, which provides a user-friendly and interactive web interface for real-time communication between users and the AI assistant by integrating multimodal AI models with multilingual speech processing capabilities, the proposed Curavox system enhances accessibility to healthcare information and improves user interaction with intelligent medical assistants. The system supports early symptom awareness, facilitates inclusive communication, and provides a scalable solution that can benefit users in remote, rural, or resource-limited environments where access to healthcare professionals may be limited.

Keywords
Multimodal Artificial Intelligence, Healthcare Symptom Analysis, Speech-to-Text (STT), Whisper Speech Recognition, Llama 3 Vision Model, Multilingual AI Systems, Text-to-Speech (TTS), Healthcare Chatbots, Vision-Language Models, AI-Based Medical Assistants.

Smart Email Prioritizer and Gmail Assistant: An AI-Powered Gmail Management System

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Abstract:

Smart Email Prioritizer and Gmail Assistant is an AI-driven Gmail management system that uses a hybrid email prioritization technique to automatically sort Gmails in order of priority. It identifies emails that need replies, creates intelligent reply content, summarizes content and Microsoft Office file attachments, and supports natural language chat queries through an interactive Streamlit interface. Smart Email Prioritizer and Gmail Assistant uses LangChain to leverage the power of multiple large language models, including Google Gemini, OpenAI GPT, Anthropic Claude, and Groq, and Gmail APIs through SimpleGmail to make email processing easier. Its effectiveness is proven by its 92% accuracy in prioritizing Gmails on actual Gmail datasets, with an average email processing time of 2.5 seconds per email and 87% precision in identifying emails that need replies, outperforming traditional rule-based systems by 28% in user productivity metrics.

DEEPFAKE DETECTION

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ABSTRACT

In recent years, the rapid advancement of artificial intelligence and deep learning has enabled the creation of highly realistic synthetic media, commonly known as deepfakes. These manipulated videos and images, generated using techniques such as Generative Adversarial Networks (GANs) and Autoencoders, pose significant threats to privacy, security, and the integrity of digital information. The objective of this project is to develop a reliable and efficient system for detecting deepfake content using state-of-the-art deep learning techniques. The proposed model leverages Convolutional Neural Networks (CNNs) to extract spatial and temporal features from facial regions in video frames, combined with feature-level fusion for improved classification accuracy. Publicly available datasets such as FaceForensics++ and Celeb-DF are utilized for training and evaluation. Performance metrics including accuracy, precision, recall, and F1-score are employed to assess the model's effectiveness. Experimental results demonstrate that the proposed approach achieves high detection accuracy and generalizes well across multiple datasets. This work contributes to the growing field of multimedia forensics by providing a robust framework for identifying AI-generated forgeries, ultimately supporting efforts to ensure digital media authenticity and trustworthiness.

This work contributes to the growing field of multimedia forensics by providing a reliable and scalable solution for detecting AI-generated forgeries. The proposed framework not only enhances digital media authentication but also supports law enforcement, journalists, and social media platforms in combating misinformation and safeguarding public trust in visual media.

A QR CODE VERIFIED MOBILE ECO-SYSTEM FOR SECURE DOCTER-PATIENT INTERACTION

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Abstract:

The proposed system is a mobile application developed using Flutter with the aim of improving the management of healthcare services in a simple and efficient manner. The primary objective of the application is to reduce confusion in appointment scheduling and to make medical information easily accessible in a secure digital format. The system is structured into three main modules: User, Doctor, and Admin. In the User module, patients can register and log in to the application using their email credentials. For security purposes, an OTP (One-Time Password) is sent to the registered email address to verify the user's identity. After successful verification, the user completes the login process by scanning a QR code, which adds an additional level of authentication and security. Once logged in, patients can check the availability of doctors, book appointments according to suitable time slots, and view their previous medical records stored in the system. This allows patients to easily track their medical history without the need to maintain physical documents.In the Doctor module, doctors can create and manage their professional profiles, update

their available consultation timings, and review appointment requests submitted by patients. Doctors can also securely access patient details by scanning a QR code linked to the patient's verified email account, ensuring that sensitive information is accessed only by authorized healthcare professionals. The Admin module manages and controls the overall functioning of the system. The administrator is responsible for managing doctor and patient records, assigning doctors when required, and monitoring ongoing consultations within the system. This centralized management helps maintain proper coordination and ensures that the application functions smoothly and efficiently. By integrating OTP authentication and QR code verification, the application enhances security and protects sensitive medical information. By integrating technologies such as OTP authentication and QR code verification, the application enhances data security and protects sensitive healthcare information. Overall, the proposed system aims to improve communication between patients and doctors, streamline appointment scheduling, and support the development of efficient digital healthcare services while reducing manual paperwork and improving service management. In addition, the system reduces manual paperwork and increases the efficiency of healthcare service management. In the future, the application can be further enhanced by incorporating advanced features such as real-time notifications, health monitoring systems, and improved data analytics. The proposed mobile application provides a user-friendly platform that enables patients and doctors to interact more effectively while improving the accessibility and management of healthcare services.

An Intelligent Traffic Sign Detection and Audio Alert System Using Image Processing and AI Models

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Abstract:

Traffic sign detection and classification are essential components of Intelligent Transportation Systems (ITS) and Advanced Driver Assistance Systems (ADAS). Accurate recognition of traffic signs improves road safety, supports autonomous driving, and assists drivers in making timely decisions. However, traditional Convolutional Neural Network (CNN)-based approaches mainly focus on local feature extraction and may face limitations under challenging conditions such as varying illumination, occlusions, motion blur, and complex backgrounds. This paper proposes a Vision Transformer (ViT)-based framework for efficient traffic sign detection and classification. The system first identifies and localizes traffic signs in input images or video frames and then classifies them into categories such as Stop, Speed Limit, and No Entry. The Vision Transformer uses a self- attention mechanism to capture global contextual relationships within images, enabling improved feature representation compared to conventional CNN models. Furthermore, a Large Language Model (LLM) is integrated to interpret the detected traffic sign and generate driving instructions. The interpreted message is converted into real-time audio alerts to assist drivers during driving scenarios. Experimental results demonstrate that the proposed approach improves robustness, contextual understanding, and classification performance, contributing to safer and more intelligent transportation systems.

PERFORMANCE EVALUATION OF POST PROCESSED MATERIAL FABRICATED VIA METAL ADDITIVE MANUFACTURING

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ABSTRACT:

Titanium alloy Ti-6Al-4V is widely utilized in aerospace and biomedical sectors due to its high strength-to-weight ratio, excellent corrosion resistance, and superior biocompatibility. With the advancement of Metal Additive Manufacturing, particularly Selective Laser Melting (SLM), complex titanium components can be produced with high precision. However, SLM-fabricated parts often contain inherent defects such as surface roughness, micro-porosity, and residual stresses that may influence their mechanical performance and long-term reliability. To overcome these limitations, post-processing techniques are essential to enhance the functional characteristics of additively manufactured materials. In this study, Ti-6Al-4V specimens fabricated using the SLM process were subjected to plasma coating to improve their surface integrity and overall performance. The material behaviour of uncoated and plasma-coated samples was comparatively evaluated in terms of microstructural characteristics, hardness, wear resistance, and surface properties. The results reveal that plasma coating significantly improves surface quality and enhances the mechanical stability of the additively manufactured alloy. Coated samples exhibited higher hardness and improved resistance to wear compared to uncoated specimens. The findings demonstrate that plasma coating is an effective post-processing strategy to improve the performance and durability of SLM-fabricated titanium alloys for advanced engineering applications.

KEYWORDS: Selective Laser Melting; Ti-6Al-4V; Post-processing; Material Properties.

SHILPASMRITI: DIGITAL PRESERVATION OF ANCIENT TEMPLES

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Abstract:.

Ancient temple inscriptions constitute invaluable historical records that document linguistic evolution, dynastic history, socio-cultural practices, and religious traditions. However, continuous exposure to environmental degradation, biological growth, and human interference has rendered many inscriptions fragile and increasingly illegible. Manual documentation methods are time-intensive and require specialized epigraphic expertise, limiting large-scale preservation efforts. This paper presents ShilpaSmriti, an AI-driven digital preservation framework designed to automatically capture, interpret, translate, and archive ancient South Indian temple inscriptions. The proposed system integrates image preprocessing, script identification, optical character recognition (OCR), neural machine translation, and cloud-based storage to convert inscription images into searchable, multilingual digital records. Scripts such as Tamil-Brahmi, Grantha, Old Kannada, and early Telugu are processed using script-specific OCR pipelines. Experimental evaluation demonstrates effective text extraction, reliable translation, and secure long-term preservation through cloud infrastructure. The framework enables global accessibility to inscription data while safeguarding cultural heritage from physical deterioration Index terms: Digital Heritage Preservation, Temple Inscriptions, Neural Machine Translation, South Indian Scripts, Cultural Heritage Digitization.

NEXT-GENERATION RESEARCH AID: INTELLIGENT KNOWLEDGE EXTRACTION FROM SCIENTIFIC LITERATURE

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ABSTRACT

The exponential growth in scientific literature has created a multitude of problems in discovering new knowledge, as traditional keyword-based search systems are not able to effectively represent the deep semantic relationships between pieces of literature for effective literature synthesis. In order to overcome these problems associated with traditional literature discovery systems, this project proposes an intelligent research assistance system that utilizes advanced Natural Language Processing (NLP) techniques and transformer-based deep learning models for effective knowledge discovery. Unlike traditional systems that consider literature as a simple text-based representation, the proposed system identifies critical 'knowledge units' related to 'research objectives,' 'methodologies,' and 'major contributions' and represents these literature pieces in an interconnected manner. The representation of relationships between 'research topics' and 'research findings' using a knowledge graph allows for high-precision semantic search and literature summarization, thereby reducing manual efforts in literature reviews. Additionally, analyzing relationships between literature pieces in the constructed knowledge graph helps in identifying 'unexplored literature' and 'future research directions.' Hence, the proposed solution is a scalable solution for enhancing overall research productivity and decision-making using a more structured and intuitive approach for discovering new knowledge in an exponentially growing scientific literature space.

Keywords: scientific publications, knowledge extraction, natural language processing (NLP), transformer-based models, semantic understanding, literature summarization, knowledge representation, semantic search,

Gamified Education Platform for Learning Integrated with AI

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Abstract

The proposed AI-Integrated Gamified Education Platform tackles the limitations of traditional e-learning by combining game mechanics with artificial intelligence. By adding gamification elements, such as points, badges, levels, and leaderboards, the system creates a competitive and rewarding environment that boosts student engagement. At its center, an "intelligence layer" uses machine learning and adaptive algorithms to analyze real-time data, including response times, interaction frequency, and performance scores. This enables the platform to adjust difficulty levels and personalize content delivery. Each student receives a customized learning path that balances challenge and skill. Supporting this personalization is a strong analytics layer for educators and administrators. With easy-to-read dashboards and visual insights, teachers can track student progress in real-time, spot learners who need help, and take prompt action to improve outcomes. Early experimental studies and pilot programs show that this approach performs better than traditional systems, resulting in higher completion rates, better understanding of concepts, and greater satisfaction overall. This scalable solution ultimately provides a data-based framework for updating education and reducing cognitive overload through smart, individualized support.

KEYWORDS : Gamified Education, Artificial Intelligence, Adaptive Learning, Learning Analytics, E- Learning.

DESIGN OPTIMIZATION AND STRESS ANALYSIS OFMULTI-JACKBOLT TENSIONERS (SUPERNUT) FOR BRAKE LINING PRESSING OPERATIONS

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ABSTRACT

Multi-Jackbolt Tensioners (Supernut) are widely used for generating high and uniform preload in heavy clamping applications; however, their application in brake lining pressing operations demands specialized design consideration due to high compressive forces, cyclic loading, and stringent load uniformity requirements. This paper presents a comprehensive design optimization and stress analysis of a Supernut system tailored for brake lining press assemblies. Analytical modeling was performed to evaluate preload generation, jackbolt load distribution, and stress transfer through the tie rod interface. Finite Element Analysis (FEA) was conducted to investigate stress concentration, deformation behavior, and structural stability under operational loading conditions. Critical design parameters were optimized to minimize peak stresses, improve load sharing efficiency, and enhance fatigue performance. The optimized configuration demonstrates improved structural reliability, reduced stress concentration, and enhanced operational durability. The proposed methodology offers a robust, efficient, and industrially viable solution for high-performance brake lining pressing systems.

Keywords: Multi-Jackbolt Tensioner, Supernut, Brake Lining Press, Finite Element Analysis, Stress Optimization, Preload Distribution.

FAUTH AI : A MULTIMODAL DEEPFAKE DETECTION USING DEEP LEARNING

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ABSTRACT :

Deepfake technology has significantly advanced in recent years, enabling the creation of highly realistic manipulated images, videos, and audio that can spread misinformation and threaten digital trust. FauthAI is proposed as a multimodal deepfake detection framework designed to identify such manipulated media effectively. The system analyzes multiple types of media simultaneously, improving the reliability and accuracy of detection compared to traditional single-modality approaches. The framework applies different deep learning models to process each media type. Convolutional Neural Networks (CNNs) are used to detect spatial artifacts in images, while Recurrent Neural Networks (RNNs) and Long Short-Term Memory (LSTM) networks capture temporal inconsistencies in video sequences. For audio analysis, spectrogram-based models are utilized to identify patterns associated with synthetic or manipulated audio signals. In addition to spatial and temporal analysis, the system examines frequency-domain artifacts and extracts meaningful features from each media modality. These extracted features help identify subtle inconsistencies that may not be visible to the human eye, thereby improving the overall detection capability of the framework. To enhance detection performance, FauthAI integrates the extracted features using multimodal fusion and ensemble learning techniques. This approach allows the system to combine information from images, videos, and audio, resulting in more accurate and robust identification of deepfake content . Furthermore, the proposed framework is designed to be scalable and adaptable to emerging deepfake generation techniques. Its flexible architecture enables continuous improvement and makes it suitable for real-world media forensics, digital security, and misinformation detection applications.

KEYWORDS : Deepfake Detection, Multimodal Learning, CNN, RNN, LSTM, Spectrogram Analysis, Frequency-Domain Analysis, Media Forensics, Ensemble Learning, Artificial Intelligence

FETAL HEALTH CLASSIFICATION AND PREDICTION USING MACHINE LEARNING

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ABSTRACT

Globally, neonatal morbidity and mortality are primarily caused by fetal health issues.Early detection of aberrant fetal conditions can enhance survival outcomes and facilitate prompt clinical intervention. Therefore, minimizing possible risks during pregnancy requires an accurate assessment of fetal well-being. In this work, a machine learning-based method for classifying fetal health using cardiotocography (CTG) data is presented. In order to help medical professionals make informed prenatal decisions, the study examines and contrasts classification algorithms like Random Forest and K-Nearest Neighbors (KNN) to classify fetal conditions into normal, suspect, and pathological classes.

Keywords: machine learning algorithms, Random Forest classifiers, KN-Neighbors classifiers, and fetal health.

EMOVISION Real-time multi-face emotion recognition using Deep Learning

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Abstract:

As online video conferencing platforms have become more popular, it has become important to know how participants feel in order to improve engagement, communication, and behavior analysis. Most current emotion recognition systems need direct access to a webcam and often have trouble making predictions that are not always right and not being able to work well in real-time meeting settings. This paper presents EmoVision, a real-time multi-face emotion recognition system developed for video conferencing. The proposed system captures the meeting window directly from the screen instead of using the webcam. This makes it easy to use with existing platforms like Google Meet without needing to change the platform. We use two convolutional neural network (CNN) models that were trained on different input resolutions (48×48 and 64×64) to preprocess and analyze the detected facial regions from the captured frames. A decision fusion mechanism that uses confidence combines predictions from both models to make them more reliable and less likely to make mistakes. To fix problems with frame-by-frame predictions that aren't stable, a sliding window is used to smooth out the most recent frames.The system can find multiple people in real time and show emotion labels and confidence scores right on the video feed. Experimental findings indicate that EmoVision provides stable and dependable emotion recognition in dynamic video conferencing environments, rendering it appropriate for online education, virtual collaboration, and behavioral analytics.

Keywords : Emotion recognition, Facial expression analysis, Video conferencing analytics, CNN ensemble, Temporal smoothing, Screen capture, OpenCV, TensorFlow/Keras, Human– computer interaction, Engagement analysis.

Food Calorie Prediction Enhancement

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Abstract

This abstract summarizes the limitations and areas for improvement in food recognition and calorie estimation models. Current models often have a limited scope, focusing primarily on food recognition or ingredient extraction, which can lead to inadequate calorie estimation, portion size determination, and dietary-specific information. Additionally, these systems face challenges with data quality, resulting in decreased accuracy and generalizability across diverse real-world food presentations. The lack of end-to-end solutions hampers comprehensive dietary assessments, as many systems require manual pre-processing. Furthermore, existing models often suffer from optimization issues, leading to inconsistent performance with new food items or varying environments. To enhance these models, several areas for improvement are identified. Developing comprehensive dietary analysis capabilities is essential, enabling accurate food recognition, ingredient identification, portion size estimation, and nutritional value calculation, including allergen flags. Strengthening robustness against real-world data variations is critical, allowing models to efficiently process imperfect images without extensive manual intervention. Integrated, real-time systems that seamlessly connect food image capture with analysis and dietary tracking applications are necessary for immediate feedback. Additionally, expanding datasets to include a wider variety of cuisines and scenarios will improve model accuracy. Lastly, continuous optimization of architectures and parameters is vital for efficient performance, especially on mobile devices.

SILICON CARBIDE BASED BI-DIRECTIONAL HIGH GAIN SEPIC CONVERTER WITH CURRENT SNUBBER FEATUREFOR RENEWABLE ENERGY APPLICATIONS

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Abstract:

Effective power converters are necessary for a renewable energy system to control input voltage fluctuations and enhance energy efficiency. The design and analysis of a silicon carbide (SiC) based bi-directional high-gain SEPIC converter with a current snubber feature for renewable energy applications are presented in this paper. The suggested converter enables bidirectional power flow between the source and the load or energy storage system by functioning in both step-up and step-down modes. The use of silicon carbide switching devices improves the overall efficiency of the converter by reducing switching losses and allowing high frequency operation. Furthermore, voltage spikes and switching stress on the power devices are reduced by a current snubber circuit which also helps to improve system reliability. Applications like solar photovoltaic systems, battery energy storage systems, and DC microgrids can benefit from the suggested topology. The performance of the converter is analysed and validated through simulation result, which demonstrate improved voltage gain, reduced switching losses and enhanced efficiency. As a result, the suggested converter is a viable option for contemporary renewable energy power conversion systems.

FINANCIAL DATA ANALYSIS USING DEEP LEARNING, BIG DATA AND EXPLAINABLE AI: A SURVEY

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Abstract:

Financial data analytics is characterized by the use of advanced analytical techniques and methods to gain meaningful insights into financial datasets generated as a result of rapid advancements in digital technology. Due to the size and complexity of financial datasets, traditional statistical techniques have failed to effectively analyze these datasets and produce reliable results. With improvements in big data analytics capabilities and the development of deep learning technologies for forecasting and decision-making in finance, use of deep learning models to analyze financial time-series and predict future market trends is made possible; thus enhancing forecasting accuracy. (e.g., Long Short-Term Memory (LSTM) models, Convolutional Neural Networks (CNNs), and Bidirectional Long Short-Term Memory (BiLSTM) models). However, many deep learning models are considered to be "black box" systems and do not provide users with insights into how model predictions were derived. As such,Explainable Artificial Intelligence (XAI) techniques enable users to understand the relationship between input features and model predictions by providing transparency. This paper presents an overview of financial data analysis using big data platforms, deep learning model methods, and XAI methods in the survey of the literature; identifies the gaps in existing research; and studies the need for integrated predictive accuracy, scalability, and interpretability of financial decision-making systems.

Keywords - Financial data analysis; deep learning; big data analytics; explainable artificial intelligence (XAI); financial forecasting.

AI- BASED PREDICTIVE PERSONAL SAFETY DEVICE

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ABSTRACT

Personal safety monitoring systems plays an important role for protecting individuals during emergency situations. Many of the existing systems rely on manual alerts or threshold-based detection methods, which are reactive and often produce high false alarm rates. Although ML techniques have been applied for anomaly detection, many approaches depend on single-modal sensor data or computationally expensive models that are unsuitable for real-time edge deployment. This work proposes a predictive multimodal personal safety framework that integrates motion, shock, GPS trajectory, and audio sensor data for real-time risk assessment. A Random Forest (RF)–based probabilistic risk aggregation model is employed due to its robustness to noisy sensor data and ability to handle heterogeneous multi-modal features. Unlike existing ML approaches that rely on single-sensor analysis, the proposed framework per-forms multimodal sensor fusion with edge-based risk prediction. Experiments using sensor data from activities such as walking, running, and sudden impact events demonstrate improved detection accuracy and reduced false alarms compared with traditional safety monitoring methods.

Keywords- Predictive personal safety, multi-modal sensor fusion, probabilistic risk aggregation, random forest, Ensemble learning, edge artificial intelligence, wearable IoT systems, and behavioral.

DESIGN AND IMPLEMENTATION OF BATTERY AND SUPERCAPACITOR HYBRID ENERGY STORAGE SYSTEM FOR ELECTRIC VEHICLE APPLICATION

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University College ofEngineering Kancheepuram
Department of Mechanical, Mechatronics and EEE
Velammal Institute of Technology

Abstract:

This paper presents an analysis of a more energy-efficient energy management between a lithium-ion battery and a supercapacitor. An electric vehicle requires an efficient energy storage system to handle changing power demands during operation. Many EVs use only batteries, but they experience high current stress during sudden accelerations. This can reduce battery performance and shorten its lifespan. To address this issue, a battery- supercapacitor hybrid energy storage system (HESS) is used. In this system, the lithium-ion battery provides the main energy required for normal vehicle operation. The supercapacitor is used to support sudden peak power demands during transient conditions. Since supercapacitors have the ability to charge and discharge very quickly, they can handle high power requirements for short durations. This helps in reducing the load and current stress on the battery. A modified DC-DC boost converter is used to increase the battery voltage to the required level. An energy management system (EMS) controls power sharing between the battery and supercapacitor depending on the load conditions. The proposed circuit consists of a lithium-ion battery, a supercapacitor, a modified DC-DC boost converter and a BLDC motor together with a three-phase inverter. The proposed circuit is designed in MATLAB/Simulink software, and its results are presented to validate the effectiveness of the system. This system reduces battery stress, improves voltage stability, and increases the overall efficiency of the system. It also helps to increase the battery life and improve the performance of electric vehicles.

Machine Learning-Driven Design and Optimization of Fiber Metal Laminates: From Materials Discovery to Performance Prediction

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Abstract

The increasing complexity of hybrid laminate architectures has made traditional experimental design approaches inefficient for exploring the vast design space associated with fiber metal laminates. Machine learning (ML) methods provide powerful tools for accelerating materials discovery and optimizing structural performance through data-driven modeling. This review provides a comprehensive overview of machine learning frameworks applied to the design and analysis of FML systems. Various ML algorithms—including artificial neural networks, Gaussian process regression, gradient boosting models, and ensemble learning techniques—are examined for predicting mechanical properties, fatigue life, and damage evolution in laminate structures. The integration of machine learning with finite element simulations and experimental datasets enables the development of surrogate models capable of rapidly exploring complex laminate configurations. Case studies demonstrating multi-objective optimization of laminate parameters such as metal thickness, fiber orientation, and adhesive properties are discussed. The review also highlights emerging approaches including physics-informed machine learning and digital twin modeling frameworks that combine physical laws with data-driven predictions. Challenges associated with limited datasets, feature engineering, and model interpretability remain significant barriers to widespread adoption. Future research directions include autonomous materials design platforms and hybrid modeling strategies that integrate experimental data, numerical simulations, and machine learning algorithms. Such approaches are expected to transform the development of advanced fiber metal laminates by enabling predictive materials design and accelerated structural optimization.

Keywords
Machine learning; Fiber metal laminates; Predictive modeling; Materials optimization; Data-driven materials science.

AI-BASED PREDICTIVE HAZARD DETECTION FOR SMART INDUSTRIAL SAFETY MONITORING

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ABSTRACT

Industrial environments often involve hazardous conditions that can lead to accidents such as fire outbreaks, toxic gas leakage, overheating, excessive vibration, and equipment malfunction. Conventional industrial safety systems primarily rely on reactive monitoring approaches that detect hazards only after they occur, resulting in delayed response and increased risk to human life and machinery. This paper proposes an AI-based Predictive Hazard Detection System for smart industrial safety monitoring. The proposed system integrates multiple sensors to continuously collect real-time data on critical parameters including temperature, gas concentration, vibration, pressure, and humidity. The collected sensor data are analysed using a Random Forest machine learning algorithm that studies historical and real-time patterns to identify abnormal trends and predict potential hazards before they escalate into dangerous incidents. The system provides early warning alerts for risks such as fire hazards, gas leakage probability, and possible machine failures, enabling proactive intervention and preventive maintenance. By shifting industrial safety management from reactive monitoring to predictive analysis, the proposed system enhances workplace safety, reduces equipment downtime, and improves operational reliability. The integration of Internet of Things (IoT) technology with artificial intelligence offers an efficient and scalable solution for next-generation smart industrial safety systems.

Keywords— Internet of Things (IoT), Artificial Intelligence (AI), Random Forest Algorithm, Predictive Hazard Detection, Industrial Safety Monitoring, Smart Sensor Systems, Early Warning System.

The Role of Artificial Intelligence in Modern Cybersecurity Strategies-Review

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ABSTRACT

Artificial intelligence has become a crucial element of cyber security because of its capacity to assess security threats in real-time and respond accordingly. AI now plays a greater role in identifying and thwarting assaults that keep companies ahead of the curve. The primary focus of AI's work in cybersecurity is threat detection and prevention. By using machine learning algorithms and sophisticated data analysis, artificial intelligence may identify patterns and irregularities in user behaviour and network traffic that might point to a possible cyberattack. This enables security staff to react swiftly and proactively to possible assaults. AI can be used to stop assaults by using predictive modelling. AI can anticipate and prevent threats by analysing previous

attacks and recognising similarities. AI plays a crucial role in cybersecurity by automating incident response processes. These systems examine data, detect dangers, and work to prevent or mitigate attacks, reducing damage and disruption. Businesses must use artificial intelligence in cybersecurity to safeguard networks and sensitive data from evolving online threats. AI's real-time data analysis and automated incident response make it a valuable tool for cybersecurity in today's digital environment. In this paper, we will discuss the role of AI in cybersecurity including its uses in threat detection and prevention.

Keywords— Cybersecurity, Artificial Intelligence (AI), threat detection and prevention, incident response system.

AI BASED CONDITION MONITORING AND FAULT DETECTION IN INDUCTION GENERATOR FOR WIND POWER STATIONS

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Abstract

Reliable operation of wind turbines is essential for ensuring stable renewable energy production. However, mechanical and electrical faults in Permanent Magnet induction generators (PMIGs) can significantly reduce efficiency and increase maintenance costs. This work presents a real-time AI-based condition monitoring framework for fault detection in wind turbine drive-train systems. Multi-sensor data including vibration, stator current, voltage, and temperature signals are collected and processed using an IoT-enabled data acquisition system. A hybrid Convolutional Neural Network–Long Short-Term Memory (CNN-LSTM) architecture is developed to automatically extract spatial and temporal fault features. Simulation-generated and experimentally validated datasets are used for supervised learning. The proposed system achieves 99.2% classification accuracy with reduced false alarm rate compared to conventional SCADA and classical machine learning methods. The framework demonstrates the effectiveness of integrating AI with IoT for predictive maintenance in wind power stations.

Keywords: Wind turbine, SCIG, fault diagnosis, CNN, LSTM, IoT monitoring, condition monitoring.

Design Of Second Order Multilayer Band Pass Filter For WiFi Application

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ABSTRACT

The rapid growth of wireless communication systems has increased the demand for efficient radio frequency (RF) filters that can provide reliable signal transmission while minimizing interference from unwanted frequencies. In particular, Wi-Fi communication operating in the 2.4 GHz Industrial, Scientific, and Medical (ISM) band requires compact and low-cost filtering solutions to ensure stable performance in modern wireless devices such as routers, smartphones, laptops, and Internet of Things (IoT) systems. Band-pass filters play a crucial role in RF front-end circuits by allowing the desired frequency band to pass while attenuating signals outside the operating range.

Therefore, the design of an efficient band-pass filter is essential for improving signal quality and enhancing the overall reliability of wireless communication systems. This work focuses on the design and simulation of a second-order band-pass filter for Wi-Fi applications operating at a center frequency of 2.4 GHz. The proposed filter is designed using lumped element techniques and implemented through electromagnetic simulation using Sonnet software. The objective of this study is to develop a compact and efficient filter structure capable of providing good selectivity, low insertion loss, and acceptable return loss within the desired frequency band. The filter design process involves the use of a low-pass prototype approach followed by frequency scaling and impedance transformation to obtain the required band-pass response. The resulting circuit is then modeled and simulated to analyze its frequency characteristics and performance parameters. In order to evaluate the influence of substrate materials on filter performance, multiple substrates are considered in this work, including FR-4, Rogers 3850 Liquid Crystal Polymer (LCP), and Low Temperature Co-Fired Ceramic (LTCC). These substrates possess different dielectric constants, loss tangents, and physical properties, which significantly affect the electromagnetic behavior of RF circuits. By implementing the same filter design on different substrates within the simulation environment, a comparative analysis is carried out to examine the effects of substrate parameters on key performance metrics such as insertion loss, return loss, bandwidth, and overall efficiency. The results demonstrate that while FR-4 offers a cost-effective and widely available solution for practical implementations, advanced substrates such as Rogers 3850 and LTCC provide improved high-frequency performance due to their lower dielectric losses and better signal stability. Simulation results indicate that the designed second-order band-pass filter successfully achieves a passband around the 2.4 GHz Wi-Fi frequency range, allowing the desired signals to pass while attenuating unwanted frequency components. The study highlights the importance of substrate selection in RF filter design and demonstrates how different materials influence signal propagation, filter response, and efficiency. The proposed design provides a simple, compact, and practical solution suitable for Wi-Fi communication systems and other wireless applications operating in the 2.4 GHz band. The comparative study presented in this work offers valuable insights for engineers and researchers in selecting appropriate substrate materials for high-frequency RF filter design while balancing performance, cost, and fabrication considerations.

ENHANCING HR EFFICIENCY WITH AIPOWERED RESUME RANKING FOR SMART TALENT ACQUISTION

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ABSTRACT

The rapid growth in job applications has made manual resume screening a time- consuming and inefficient task for Human Resource (HR) professionals. To address this challenge, this paper proposes an AI-powered resume ranking system designed to enhance HR efficiency and support smart talent acquisition. The proposed system analyzes multiple candidate resumes for specific job roles and evaluates them based on skills, keywords, and experience. Using the Gemini API, resumes are processed through natural language understanding techniques to identify relevance and match scores. The system then ranks resumes and assigns a score, enabling recruiters to quickly identify the most suitable candidates. In addition, the proposed approach ensures consistency and scalability in recruitment by handling large volumes of resumes with minimal human intervention. The system supports data- driven decision- making and improves the overall quality of candidate short listing. By reducing screening time and effort, the solution contributes to faster hiring cycles and more effective

talent acquisition strategies. The proposed system is flexible and can be adapted to different job roles and industry domains. It also promotes fair and unbiased screening by relying on objective evaluation criteria rather than manual judgment. Overall, this AI- driven resume ranking framework serves as a practical and efficient tool for modern recruitment processes.

Key words: Resume Ranking, Artificial Intelligence, Talent Acquisition, HR Automation, Gemini API.

Multi-Agent AI System for Automated Software Setup

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ABSTRACT

Individuals across academic, industrial, and training environments—including non-computer science learners, technology newcomers, educators, trainees, and professionals—often face difficulties installing and configuring development tools. Manual setup requires version selection, dependency resolution, environment configuration, and error handling, making it time-consuming and error-prone for users with limited technical expertise. This paper presents a Cross-Platform Multi-Agent AI Installer, an intelligent framework designed to automate the installation and configuration of development environments while addressing the limitations of existing setup tools. The proposed system employs multiple autonomous agents to collaboratively plan, execute, monitor, and recover software installations in real time. It supports Windows, Linux, and macOS platforms, handling diverse installer formats including .exe, .msi, .deb, and .dmg, as well as native package managers. The Planner Agent determines a dependency-aware installation sequence, the Installer Agent performs silent and unattended installations, the Monitor Agent verifies execution outcomes, and the Recovery Agent enables self- healing through retries, alternative installation strategies, and context-aware user prompts when necessary. To overcome the limitations of deterministic rule-based automation, the system integrates an LLM-based reasoning module for intelligent failure diagnosis and decision-making, thereby improving robustness and installation success rates. Additionally, scheduler-based automation and voice-command interfaces facilitate seamless initiation of installations, while a graphical user interface provides real-time logs, progress indicators, and environment validation. Experimental results show that the proposed system reliably provisions development environments across platforms, achieving an installation success rate of 96%, a dependency verification accuracy of 98%, a scheduling accuracy of 99%, and a download completion rate of 99%. The framework autonomously resolves dependencies, handles failures intelligently, and minimizes setup time and user intervention, providing a scalable and user-friendly solution for diverse technical user groups.

Keywords

Multi-Agent AI, Automated Software Setup, Cross-Platform Installation, Dependency Resolution, Self- Healing Systems, LLM-Assisted Automation

ADAPTIVE EDGE INTELLIGENCE FRAMEWORK FOR PREDICTIVE DIAGNOSTICS IN SMART INDUSTRIAL ENVIRONMENTS

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ABSTRACT

Predictive diagnostics is essential for improving the reliability and efficiency of modern

industrial systems. This paper presents an Adaptive Edge Intelligence Framework for predictive diagnostics in smart industrial environments. The proposed system collects real-time sensor data such as temperature, vibration, and operational parameters from industrial machines and processes it locally at the edge using embedded devices. Lightweight machine learning–based anomaly detection techniques are employed to analyze sensor data and identify abnormal patterns that indicate potential machine faults. By performing data processing at the edge, the system reduces latency, minimizes dependency on cloud infrastructure, and enables faster decision-making. The proposed framework is scalable, cost-effective, and suitable for real-time industrial monitoring. It supports proactive maintenance, reduces unexpected downtime, and enhances the overall reliability of industrial machinery. Experimental observations demonstrate that the system effectively improves predictive maintenance capabilities in smart industrial environments.

AI-POWERED HYBRID FRAMEWORK FOR SKIN DISEAS IDENTIFICATION USING HYPER-CNN

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ABSTRACT

Automated skin disease classification using dermoscopic images has gained significant attention due to the rising incidence of skin-related disorders and the need for early diagnosis. However, the complex visual patterns of skin lesions, including variations in color, texture, shape, and scale, make accurate classification a challenging task. Conventional convolutional neural networks (CNNs) often suffer from limited feature representation and poor generalization when dealing with such high intra-class variability. To address these challenges, this paper proposes an AI-powered hybrid deep learning framework combining Hyper-Convolutional Neural Networks (Hyper-CNN) and Efficient Net for robust skin disease identification. In the proposed approach, Efficient Net is employed as a powerful feature extractor due to its compound scaling strategy, which efficiently balances network depth, width, and resolution to capture high-level semantic features from skin lesion images. These extracted features are further enhanced using a custom-designed Hyper-CNN architecture, which incorporates deeper convolutional blocks, batch normalization, and adaptive dropout mechanisms to learn fine-grained dermatological patterns. The hybri framework enables effective extraction of both global and local lesion characteristics, improvingdiscriminative capability across multiple skin disease classes. The proposed model is evaluated using the HAM10000 skin lesion dataset, achieving improvedclassification accuracy, stability, and confidence scores compared to traditional CNN-based methods. Experimental results demonstrate that the integration of Efficient Net with Hyper-CNN significantly enhances feature representation, reduces overfitting, and improves generalization performance. The proposed hybrid framework provides a reliable and scalable solution for automated skin disease diagnosis and has strong potential for deployment in real-time clinical decision-support systems.

Keywords

Skin disease classification, dermoscopic images, deep learning, EfficientNet, Hyper-Convolutional Neural Network (Hyper-CNN), hybrid model, medical image analysis, automated diagnosis, HAM10000 dataset.

Design and Implementation of IoT-Based Smart Grid with Solar and Wind Energy Integration

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ABSTRACT

The rapid growth in electricity demand and the increasing concern over environmental pollution have created a strong need for efficient and sustainable power management systems. Smart grid technology, combined with renewable energy sources, offers a promising solution to address these challenges. This project proposes a Smart Grid System with Renewable Integration that utilizes solar and wind energy along with Internet of Things (IoT) technology to achieve reliable and efficient power distribution. In the proposed system, solar panels and wind turbines generate clean electrical energy, which is conditioned and supplied to the grid. IoT-based sensors continuously monitor important electrical parameters such as voltage, current, and power in real time. A microcontroller collects this data and transmits it to a cloud platform for remote monitoring and analysis. The system intelligently manages the balance between power generation and load demand, while excess energy is stored in a battery backup to ensure uninterrupted power supply during low generation periods. The smart grid also incorporates automatic fault detection and alert mechanisms to identify overloads, voltage fluctuations, and source failures. By enabling real- time monitoring, intelligent load management, and effective renewable energy utilization, the proposed system improves overall grid reliability and efficiency. This approach reduces power losses, lowers carbon emissions, and supports the development of a sustainable and future-ready power distribution network.

Live sign language translation via computer vision

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ABSTRACT

A live sign language translation system that bridges the communication barrier between the hard-of-hearing and hearing community is a key benefit of this research project. The proposed sign language translation system will operate in real-time using computer vision and deep learning algorithms. Using a camera, gesture recognition is performed on individual video frames to identify sign language gestures. The accuracy of the translation process is improved by applying various types of preprocessing techniques (i.e., resizing, normalizing data, and removing background noise) to the frames. Convolutional Neural Networks (CNN) will be used to extract features from the videos (frames), while Long Short-Term Memory (LSTM) networks will be used to model the temporal sequence of the gestures to understand how the gestures are being made regardless of how closely they are related to each other in time. After the signs have been recognized by the proposed system, the signs will be represented as a corresponding text value and also have the ability to convert into voice or spoken words. The goal of this proposed design is to provide an accurate and timely method of translating daily communication scenarios for users of the proposed design. By having the potential for real-time translation of gestures into text format, the results of this research study will help develop further advancements in the technology of communication and improve accessibility for the deaf and hard-of-hearing communities.

LANDSLIDE PREDICTION USING FUSED CNN MODEL

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ABSTRACT:

Landslides are one of the most destructive natural disasters, causing crucial damage to human life, infrastructure, and the surrounding environment. Early detection and prediction of landslides can play a crucial role in minimizing potential losses and supporting effective disaster management and mitigation strategies. Satellite images serve as the main data source for analyzing terrain conditions. The fused CNN model, which combines CNN and ResNet architectures, uses sophisticated deep learning techniques to identify and forecast landslide-prone locations. A Convolutional Neural Network extracts spatial features from the images and identifies patterns linked to landslide occurrences. A ResNet (Residual Network) model is also incorporated to capture intricate feature representations and enhance the system's learning capability. A fusion algorithm combines the characteristics taken from the CNN and ResNet models to improve prediction performance. As a result, the system

produces more accurate and dependable predictions. Keywords : CNN, ResNet, Prediction, Fused Model.

Design and FPGA Implementation Of Low Power and High Speed Sparse Multiplier Unit

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Abstract

Low-power and high-speed arithmetic units are emerging as a necessity with the continued evolution of modern embedded systems and signal processing platforms. These systems often work on data sets that have a large number of zeros, and hence traditional multipliers become inefficient due to their high switching activity and redundant computations. This paper presents the design and implementation of a sparse multiplier unit that efficiently leverages the data sparsity to minimize computational complexity. The proposed sparse multiplier unit generates partial products only for the non-zero parts of the operands, thus allowing for lower dynamic power consumption without sacrificing computational accuracy. High-speed adder architectures were selected to ensure minimal critical path delays and thus maintain high throughput rates despite the constraints of real-time processing. Parametric simulations and FPGA-based synthesis were carried out to assess the performance of the proposed design in terms of its delay, area overhead, switching activity, and dynamic power consumption. The results unequivocally show faster processing and substantial power savings over traditional multiplier architectures. The sparse multiplier unit is a viable, compact, and power-efficient solution for next-generation embedded and signal processing platforms that demand high-speed arithmetic processing.

Index Terms - Sparse Multiplier Unit, Low-Power Arithmetic Circuits, High-Speed Digital Multipliers, FPGA Implementation, Sparse Data Processing, Partial Product Reduction, Low-Switching Architectures, Energy-Efficient VLSI Design, High-Performance Embedded Systems.

An Energy-Aware Anomaly Detection Framework for Wireless Sensor Networks Based on Inverse Weight Clustering and C5.0 Decision Tree

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Abstract

Wireless Sensor Networks (WSNs) are extensively utilized in industrial automation, healthcare and environmental monitoring. However, these networks are extremely susceptible to anomalies brought on by malicious attacks, sensor malfunctions, and communication

errors, which can be shorten network lifetime and reduce data reliability. Thus, a crucial problem in WSNs continues to be accurate and energy-efficient anomaly detection. In this paper proposes an anomaly detection framework for wireless sensor networks by combining Energy-Aware Optimization (EAO) and Inverse Weight Clustering (IWC) with a C5.0 decision tree classifier. In order to efficiently organize data and reduce redundant transmissions, a simulated WSN dataset is first used, and sensor nodes are grouped according to distance, residual energy, and communication weight using inverse weight clustering. The network lifetime is then increased by using energy-aware optimization to choose energy-efficient cluster heads and balance network load. In order to correctly classify sensor nodes as normal or anomalous, the C5.0 decision tree model is then trained using extracted cluster-level features. Standard metrics like accuracy, detection rate, and dales alarm rate are used to assess the effectiveness of the suggested method. The hybrid IWC-C5.0 model successfully detects anomalous sensor nodes while preserving low false alarms and enhanced energy efficiency, according to experimental results.

Keywords – Wireless Sensor Networks, Anomaly Detection, Inverse Weight Clustering, C5.0 Decision Tree, Energy-Aware Optimization, Cluster-Based Classification, Network Lifetime, False Alarm Rate.

AI-Augmented Soil Fertility Index Generation Using Temporal and Visual Deep Learning Models

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Soil fertility plays a critical role in agricultural productivity; however, conventional soil fertility assessment methods rely primarily on static soil tests that fail to capture temporal variations in soil conditions and early crop nutrient stress signals. These limitations often result in delayed interventions and inefficient fertilizer usage. To address this challenge, this study proposes an intelligent AI-driven Soil Fertility Index (SFI) generation system that integrates soil parameters, environmental factors, and crop visual indicators to provide dynamic and accurate fertility assessment. The proposed framework utilizes Long Short-Term Memory (LSTM) networks to analyze historical soil and weather data, enabling the model to learn temporal fertility trends and predict soil health variations over time. Key soil attributes such as nitrogen (N), phosphorus (P), potassium (K), pH, humidity, and temperature are used as inputs to capture the evolving soil conditions affecting crop growth. To complement temporal analysis, a Convolutional Neural Network (CNN) is employed for visual crop analysis by detecting nutrient deficiencies from leaf characteristics. A Leaf Color Classification (LCC)–based interface is integrated to allow users to select the closest matching leaf color shade, enabling the system to estimate nutrient status and fertility score through visual cues. Additionally, soil images are incorporated to enrich the dataset and improve the robustness of fertility prediction. Outputs from the temporal LSTM model and the CNN-based visual analysis are fused to generate a comprehensive Soil Fertility Index, expressed as a percentage score and categorized into fertility levels such as Good, Moderate, or Poor. To enhance model transparency and user trust, Explainable Artificial Intelligence (XAI) techniques using SHAP (SHapley Additive exPlanations) are applied to interpret model predictions and highlight the contribution of each input parameter to the final fertility score. Beyond fertility assessment, the system provides personalized fertilizer recommendations and crop suggestions based on the predicted soil condition. A conversational AI chatbot interface further supports farmers by delivering real-time guidance, answering queries, and simplifying interaction with the system. By combining time-series analysis, deep learning-based

visual diagnostics, explainable AI, and decision support mechanisms, the proposed system offers a comprehensive approach to precision agriculture. The framework aims to improve fertilizer efficiency, support sustainable farming practices, and enable farmers to make informed decisions through transparent and data-driven soil fertility insights.

Design and Performance Analysis of Quasi Z-Source Inverter for Solar PV Systems with Maximum Power Extraction

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Abstract

Advanced inverter topologies for solar photovoltaic systems are the subject of increased research due to the growing need for effective renewable energy conversion. Under variable solar conditions, conventional voltage source inverters are less reliable and have a limited capacity for voltage boosting. In order to obtain dependable voltage boost and maximum power extraction, this work suggests designing and analyzing the performance of a Quasi Z-Source Inverter combined with a solar photovoltaic system. By enabling shoot-through states without endangering the inverter, the impedance network ensures increased voltage gain and system resilience. The ideal operating point is tracked under various irradiance situations using a maximum power extraction technique. Important performance metrics including voltage gain, efficiency, total harmonic distortion, and dynamic response are assessed once the suggested system is modeled and simulated. The results show steady functioning under fast solar changes, decreased harmonic distortion, and enhanced voltage boosting capability. The Quasi Z-Source Inverter offers a dependable and effective solution for solar photovoltaic applications, according to the study.

Keywords
Quasi Z-Source Inverter, Solar Photovoltaic System, Maximum Power Extraction, Voltage Boosting, Renewable Energy Conversion.

NUMERICAL STUDY OF THE IMPACT OF WINGLET SERRATIONS ON AERODYNAMIC PERFORMANCE

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Abstract

Wingtip vortices are the primary source of induced drag, thus, significantly altering aircraft performance negatively. This numerical study is conducted to evaluate the aerodynamic impact of trailing edge serrations on winglets using Computational Fluid Dynamics (CFD). Three different serration patterns small triangular serrations, big triangular serrations, and sinusoidal serrations were modeled and compared against a baseline winglet. CFD Simulations were conducted by varying the angle of attack (AOA) to 0°, 5°, and 9° with inlet velocities of 25m/s, 40m/s, and 60 m/s. The CFD results indicates that while the triangular serrations provide the highest drag reduction at 0° AOA, the sinusoidal serrated model offers superior overall performance at higher angles of attack. The sinusoidal geometry delays localized flow separation and effectively diffuses the vortex core, enhancing the lift-to-drag ratio across a wider operational range.

Keywords: COEFFICIENT OF DRAG, COEFFICIENT OF LIFT, INLET VELOCITY, PRESSURE OUTLET, SERRATIONS, WINGLET.

AutoFAIR: A Model-Agnostic Automated Framework for Bias Detection and Adaptive Fairness Mitigation

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ABSTRACT

As machine learning systems increasingly influence high-stakes decisions, ensuring fairness across demographic groups has become a fundamental requirement for trustworthy artificial intelligence. Predictive models—regardless of their underlying learning paradigm—may exhibit statistical, error-rate, and distributional disparities across protected attributes, even when achieving strong predictive performance. This paper presents AutoFAIR, a model-agnostic fairness auditing and adaptive mitigation framework designed to operate across diverse learning models and datasets without structural modification. The framework computes seventeen fairness metrics spanning statistical parity, error-rate balance, predictive reliability, individual consistency, and inequality-based measures. A threshold-driven severity classification mechanism transforms metric deviations into structured violation signals, while a dominance-based decision logic automatically selects appropriate mitigation strategies, including reweighing, equalized odds adjustment, threshold optimization, disparate impact removal, exponentiated gradient reduction, and label massaging. In addition, a fairness drift monitoring component periodically evaluates deployed models and re-triggers mitigation when violations re-emerge. Experimental validation across benchmark datasets demonstrates substantial bias reduction with controlled impact on predictive performance, highlighting the effectiveness of integrating automated auditing, adaptive correction, and continuous fairness monitoring within a unified, scalable framework.

AutoFAIR: A Model-Agnostic Automated Framework for Bias Detection and Adaptive Fairness Mitigation

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ABSTRACT

As machine learning systems increasingly influence high-stakes decisions, ensuring fairness across demographic groups has become a fundamental requirement for trustworthy artificial intelligence. Predictive models—regardless of their underlying learning paradigm—may exhibit statistical, error-rate, and distributional disparities across protected attributes, even when achieving strong predictive performance. This paper presents AutoFAIR, a model-agnostic fairness auditing and adaptive mitigation framework designed to operate across diverse learning models and datasets without structural modification. The framework computes seventeen fairness metrics spanning statistical parity, error-rate balance, predictive reliability, individual consistency, and inequality-based measures. A threshold-driven severity classification mechanism transforms metric deviations into structured violation signals, while a dominance-based decision logic automatically selects appropriate mitigation strategies, including reweighing, equalized odds adjustment, threshold optimization, disparate impact removal, exponentiated gradient reduction, and label massaging. In addition, a fairness drift monitoring component periodically evaluates deployed models and re-triggers mitigation when violations re-emerge. Experimental validation across benchmark datasets demonstrates substantial bias reduction with controlled impact on predictive performance, highlighting the effectiveness of integrating automated auditing, adaptive correction, and continuous fairness monitoring within a unified, scalable framework.

OpenAPI to Model Context Protocol (MCP) Server Generator for Large Language Models

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ABSTRACT

The OpenAPI to Model Context Protocol (MCP) Server Generator addresses a critical gap in the current AI ecosystem, where Large Language Models (LLMs) are increasingly tasked with interacting with external systems but lack the native capability to invoke APIs directly. To facilitate secure interaction, LLMs depend on MCP servers; however, these servers are typically developed manually, resulting in a process that is time- intensive, error-prone, poorly standardized, and vulnerable to security risks such as unsafe API execution and privilege misuse. Currently, no automated, privilege-aware framework exists to bridge this gap. The primary goal of this research is to develop an automated pipeline that converts static OpenAPI (v3+) specifications into production-ready, MCP-compliant FastMCP servers with structured, deterministic tools, effectively eliminating manual boilerplate coding while reducing overall security risks. The proposed system employs a zero-code transformation engine built on a sophisticated 4-stage technical pipeline. The process begins with an ingestion stage where a Streamlit-based interface handles secure file uploads of JSON or YAML specifications while enforcing DoS protection via file-size limits. During the normalization stage, an OpenAPI Resolver utilizes a Registry Pattern and visited-set tracking to resolve complex object trees and break circular references that often crash standard generators. The synthesis stage involves an Intermediate Representation (IR) builder that maps API paths to compact Python functions using a smart parameter flattening algorithm to deconstruct nested JSON into flat arguments, reducing LLM token bloat by 95%. Finally, a generation stage uses a Jinja2-based engine to synthesize standalone server.py and executors.py files using the FastMCP framework and asynchronous HTTPX logic. The system successfully generates a standalone MCP package that supports both STDIO and SSE transport protocols and is fully compatible with the MCP Inspector and various MCP clients. Key technical contributions include the elimination of 95% of manual boilerplate code and the implementation of a "Least Privilege" principle through automated tool exposure. The final output is a dockerized deployment bundle ready for production-level LLM integration, providing a standardized and secure "API-to-AI" bridge. These advancements ensure that every generated tool follows strict schema boundaries to minimize the risk of privilege misuse or data exfiltration.

Keywords: Large Language Models, OpenAPI, Model Context Protocol (MCP), Automated Code Generation, API Security, FastMCP.

Graph Based Health Insurance Fraud Detection Uang CA SHINE Framework

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ABSTRACT

The issue of health insurance fraud is an important one that poses a great threat to financial institutions and the smooth delivery of healthcare services. The existing approaches to detect fraudulent activities using a single data source are not sufficient to detect complex patterns and underlying relationships that exist within heterogeneous data related to health insurance services. The

following is a description of the proposed system based on the multi-view graph neural network framework for detecting fraudulent healthcare providers based on the comprehensive relational learning mechanism. The system is based on the fusion of four heterogeneous CSV data sources related to provider labels, beneficiary demographics, inpatient claims data, and outpatient claims data. The system aggregates the features related to each healthcare provider to generate a comprehensive profile that captures billing patterns, volumes of claims, cost distributions, and deductibles. The system generates four heterogeneous graphs based on the generated provider profiles using cosine similarity KNN, Euclidean KNN, cost behavior proximity, and claim volume proximity. The system utilizes a confidence fusion optimizer based on the graph convolutional network and multilayer perceptron to assign confidence to the edges of the graph to eliminate noise. The core model utilizes four independent encoders from the Graph Attention Network to concurrently learn view-specific node embeddings from all four perspectives. The Cross-Attention mechanism is further utilized to intelligently integrate these four 256-dimensional embeddings by learning the views that carry the highest discriminative fraud signals for each provider. The integrated embeddings are further passed through a linear classifier that is trained using a combination of Cross-Entropy and contrastive divergence loss functions. The use of a multi-view graph effectively captures fraud signals that would otherwise remain undetectable by single-view methods. The provider-level detection further allows for actionable intelligence that can be applied in real-world insurance audits. Future plans include the use of a weighted loss function for balancing classes and inductive learning for real-time scoring for newly registered providers.

DESIGN AND DEVELOPMENT OF MULTIPURPOS AGRICULTURAL MACHINE

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ABSTRACT

The modern agricultural sector faces significant challenges, including rising labor costs, a shortage of skilled workers, and the inefficiency of using multiple heavy machines for basic farming tasks. This project focuses on the Design and Development of a Multipurpose Agricultural Machine specifically engineered to streamline core farming operations seed sowing, weeding, and pesticide spraying into a single, integrated platform. The machine is built on a robust mild steel chassis and utilizes a Bluetooth-controlled automation system, allowing for remote operation and enhanced user safety. A high-torque DC motor drives the weeding mechanism, while a precision-calibrated hopper system ensures uniform seed distribution. Additionally, an integrated 12V DC pump and nozzle assembly provide efficient liquid spraying with minimal waste. By consolidating these three critical functions into one compact, cost-effective unit, this multipurpose machine reduces the physical strain on farmers, lowers operational expenses, and improves overall productivity for small and medium-scale agricultural land. The rising cost of agricultural labor and the need for time-efficient farming tools have necessitated the Design and Development of a Multipurpose Agricultural Machine. This project addresses these challenges by consolidating the three most time-consuming farming activities weeding, sowing, and spraying into one versatile device. Through a systematic design approach, the machine was developed to be lightweight, cost-effective, and easy to operate. Experimental results and field observations indicate that the multipurpose unit can reduce operational time by approximately 40% compared to traditional manual methods. Ultimately, this machine serves as a sustainable tool for small- scale farmers, aiming to increase crop yield while significantly lowering the overall cost of production." In the era of Agriculture 4.0, automation is key to enhancing

field efficiency. This work details the Design and Development of a Multipurpose Agricultural Machine equipped with Bluetooth-based remote- control capabilities. By utilizing an Arduino based microcontroller and an HC-05 Bluetooth module, the machine allows operators to manage weeding, sowing, and spraying tasks from a safe distance, minimizing direct exposure to hazardous chemicals. The development process involved circuit integration for motor synchronization and the implementation of a portable power system. This smart multipurpose machine bridges the gap between traditional manual labour and expensive heavy machinery, offering a technologically advanced yet user- friendly alternative for the next generation of farmers.&quot

AI-BASED MOTOR FAULT DETECTION AND PREDICTIVE MAINTENANCE

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Abstract:

Since electrical motors are extensively utilized in various industrial operations, it is important that motors are always running to ensure productivity. Unexpected failures of motors could cause downtime and additional maintenance expenses. The paper aims to propose an artificial intelligence-based electrical motor fault detection system using a multi-sensor approach. In this paper, a system is proposed that utilizes various sensors such as vibration, current, temperature, and speed sensors connected to an ESP32 microcontroller to acquire data from those sensors. The collected data from the vibration sensor is then analyzed using signal processing techniques such as Fast Fourier Transform (FFT) and spectrogram analysis to obtain important features from the signal that are related to motor health. A Convolutional Neural Network (CNN) model is proposed for the classification of various motor conditions including healthy operation, bearing faults, misalignment, unbalance, and stator winding faults. Besides fault classification, a Long Short-Term Memory (LSTM) network is employed in the proposed work for estimating the remaining useful life of the motor. The proposed method is implemented using a MATLAB simulation environment. Moreover, a hardware implementation of the proposed method using sensors, an ESP32 module, and a relay-based protection scheme is also presented. The proposed method can be used for early fault detection of the motor and intelligent maintenance of the motor. Hence, the proposed method can be used to reduce unexpected motor failure in industrial motor applications.

Keywords: Motor Fault Detection, Predictive Maintenance, Convolutional Neural Network (CNN), Long Short-Term Memory (LSTM), Fast Fourier Transform (FFT), Vibration Analysis, ESP32, Multi- Sensor Monitoring.

AI-Based Student Career Guidance Chatbot Using Intent Detection and Retrieval-Augmented Generation

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ABSTRACT

Access to accurate and timely admission and career guidance information remains challenging due to fragmented data sources, frequent updates, and reliance on manual enquiry systems. Students and parents often struggle to obtain reliable details regarding eligibility criteria, cut-offs, fee structures, scholarships, hostel facilities, and placement opportunities. Existing solutions such as static websites and rule-based chatbots lack semantic understanding and scalability, while standalone language models risk generating hallucinated responses without factual grounding. This

paper proposes an AI-based Student Career Guidance Chatbot using an intent-aware Retrieval-Augmented Generation (RAG) framework. User queries undergo Natural Language Processing and intent detection, followed by a decision layer that routes requests to a FAISS- based vector database for semantic retrieval or to a controlled search agent when data is missing or outdated. Retrieved context is supplied to a transformer-based language model to generate fact-grounded responses. The system is implemented using a FastAPI backend and a Gradio-based frontend, ensuring low latency, scalability, and reliable information delivery.

Analysis Of Underwater Laser Welding on Aluminium Alloys for Repairs of Submarines Structures

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Abstract:

The study is based on underwater laser welding (ULW) on marine grade aluminium alloy – AA5083. The experimentation analysis of parametric effects of power and frequency in ULW. The power and frequency both parameters are experimented and sampled by predetermined parameter values, the samples are prepared by varying one parameter within the predetermined range, while the other parameter is held at its median value of the predetermined range and it's also done in vice versa to note the other parameter effect too. isolating individual influences on weld integrity. Then the produced samples are subject to tensile strength test, the samples that shows maximum tensile strength in both parameters are subjected to microscopic analysis to observe the micro structure and grains of those samples and to find the optimal conditions for robust, sustainable submarine repairs.

AI-Driven Crowd Prediction and Time-Slot Optimization for Cultural Heritage Sites

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Abstract

Cultural heritage sites represent invaluable historical, cultural, and architectural assets that attract millions of visitors every year. However, the rapid growth of tourism has created significant challenges in managing visitor flow, particularly during peak seasons and public holidays. Excessive crowd density can lead to long waiting times, reduced visitor satisfaction, safety risks, and potential damage to fragile heritage structures. Traditional visitor management techniques such as manual monitoring, fixed entry limits, and static ticket booking systems often fail to respond dynamically to fluctuating visitor patterns. Therefore, there is an increasing need for intelligent and adaptive solutions that can effectively manage crowd flow while ensuring the preservation of heritage sites. This study proposes an Artificial Intelligence (AI)-driven framework for predicting crowd density and optimizing visitor time-slot allocation at cultural heritage locations. The proposed system utilizes machine learning techniques and predictive analytics to analyze historical visitor data, seasonal patterns, weather conditions, and special event schedules in order to forecast expected crowd levels at different time intervals. By applying time-series analysis and classification-based prediction models, the system is capable of identifying peak hours and estimating visitor density in advance. Based on the predicted crowd patterns, an intelligent time-slot optimization mechanism is implemented to distribute visitors

more evenly throughout the day. During the ticket booking process, the system recommends optimal visiting slots to tourists, thereby reducing congestion during peak periods. This approach not only enhances the visitor experience but also ensures efficient utilization of site capacity. The framework also integrates real-time data inputs from ticketing platforms and visitor monitoring systems, allowing administrators to continuously track crowd conditions and make data-driven decisions for crowd control.Furthermore, the proposed solution supports sustainable tourism management by protecting heritage structures from excessive physical stress caused by overcrowding. By balancing visitor distribution and reducing congestion, the system contributes to the long-term conservation of culturally significant sites while maintaining a smooth and enjoyable experience for tourists. The AI-driven crowd prediction and scheduling system aligns with the principles of smart tourism and Industry, where advanced technologies collaborate with human management to create intelligent, adaptive, and sustainable tourism environments. The model demonstrates the potential to transform traditional crowd management strategies into data-driven systems that improve operational efficiency, enhance visitor satisfaction, and safeguard cultural heritage resources for future generations.

Keywords: Artificial Intelligence, Crowd Prediction, Time-Slot Optimization, Smart Tourism, Cultural Heritage Management, Visitor Flow Management.

Hybrid CNN–LSTM Model for Drone-Based Solar Panel Anomaly Detection and Rainfall-Aware Cleaning Optimization

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Abstract:

The efficiency of solar panels is significantly affected by surface anomalies such as dust accumulation, bird droppings, and electrical damage, which reduce energy output if not addressed promptly. Most existing automated inspection systems rely primarily on object detection and image classification, often overlooking environmental factors that influence dust accumulation and natural cleaning events such as rainfall. This study proposes a drone-assisted hybrid deep learning system that integrates Convolutional Neural Networks (CNN) with Long Short-Term Memory (LSTM) models to enhance solar panel monitoring and maintenance planning. The objective is to develop a system capable of classifying panel anomalies while simultaneously analysing environmental data to forecast rainfall during scheduled cleaning operations. The proposed approach utilizes a custom CNN model for classifying solar panel surface conditions using image datasets obtained from Kaggle and Roboflow Universe. Environmental parameters associated with the solar farm environment are incorporated and processed using an LSTM model to identify temporal patterns and forecast the likelihood of rainfall. The models were implemented and trained using Google Colab, enabling efficient data processing and experimentation with the hybrid architecture.

Experimental results indicate that the trained system successfully classifies solar panel anomalies and predicts rainfall probability based on environmental data patterns. The integration of environmental forecasting with anomaly detection provides additional metadata that can support optimized maintenance scheduling. This hybrid framework demonstrates the potential to improve solar farm operational efficiency by enabling smarter, data-driven decisions for automated solar panel inspection and cleaning. Future work may focus on improving prediction accuracy through larger datasets and real-time environmental sensor integration.

DESIGN AND IMPLEMENTATION OF SOLAR ASSISTED DC TO DC CONVERTER FOR ELECTRIC TWO WHEELERS

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ABSTRACT

In many parts of the world, especially in remote and rural regions, access to reliable electricity remains a daily challenge that directly affects comfort, productivity, and quality of life. Frequent power cuts, rising energy costs, and dependence on non-renewable sources create a strong need for a smarter and more sustainable energy solution. This project presents an intelligent renewable energy management approach designed to harvest natural energy during the day, store it efficiently, and distribute it automatically whenever needed without human intervention. The system continuously monitors available energy, makes real-time decisions on how power should be stored and utilized, and ensures that essential services continue to function even during outages or low-energy conditions. By prioritizing efficient usage and preventing energy wastage, the solution improves reliability while extending the lifespan of the storage system. It acts like a small autonomous energy manager that learns when to conserve power, when to supply it, and how to maintain a stable balance between generation and consumption. Such an approach can significantly benefit households, farms, and small businesses that struggle with inconsistent electricity supply, enabling critical applications like ventilation, automation, and small-scale machinery to run smoothly. Ultimately, the idea demonstrates how smart energy management can reduce dependency on conventional power grids, promote clean energy adoption, and offer a cost-effective pathway toward energy independence, sustainability, and uninterrupted daily life.

MICROSTRUCTURAL ANALYSIS AND MICROHARDNESS EVALUATION OF PLASMA SPRAYED COATINGS ON LMDFABRICATED TI-6AL-4V ALLOY

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ABSTRACT

Metal Additive Manufacturing (MAM) has emerged as a promising technology for producing complex metallic components with high design flexibility and reduced material wastage. Among the various MAM techniques, Laser Metal Deposition (LMD) has gained significant attention due to its capability for near- net-shape fabrication and material repair applications. However, components fabricated through LMD often exhibit surface irregularities, residual stresses, and microstructural heterogeneity that may affect their mechanical performance. In this study, a metallic component was fabricated using the LMD process under optimized processing parameters. The fabricated part was subsequently sectioned into test specimens through precision cutting to ensure dimensional accuracy. One specimen was retained in the as-fabricated condition, while another specimen underwent post-processing through a surface coating technique intended to improve surface integrity and mechanical performance. Both specimens were subjected to mechanical characterization and comparative evaluation. The experimental results demonstrated that the coated specimen exhibited enhanced mechanical performance compared to the as-fabricated specimen. The findings establish a clear correlation between post-processing treatment and performance improvement in LMD-fabricated materials, highlighting the importance of surface engineering techniques in improving the functional reliability of metal additive manufactured components for advanced engineering applications.

KEYWORDS: Laser Metal Deposition; Ti-6Al-4V; Post-processing; Material Properties.

SMART ACADEMIC TIMETABLE GENERATION SYSTEM

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Abstract

Timetable scheduling is a critical administrative task in higher education institutions, involving the allocation of subjects, faculty, classrooms, and time slots while satisfying numerous academic and institutional constraints. Traditional manual and spreadsheet-based timetable preparation methods are time-consuming, error-prone, and difficult to adapt to changes, often resulting in class clashes, inefficient classroom utilization, and uneven faculty workload. With the introduction of multidisciplinary education, electives, and flexible curricula under the National Education Policy (NEP-2020), the complexity of academic timetable management has increased significantly, creating a strong need for an intelligent and automated solution. This project proposes a web-based Automated Academic Timetable Scheduling System developed using the MERN stack (MongoDB, Express.js, React.js, and Node.js) to efficiently generate optimized and conflict-free timetables. The system provides a centralized platform where administrators can input essential scheduling data such as faculty availability, subject details, classroom capacity, academic constraints, and institutional rules. Using intelligent scheduling logic based on constraint satisfaction and heuristic optimization principles, the system automatically generates feasible timetables while ensuring adherence to hard constraints such as faculty clashes and room availability, and optimizing soft constraints such as workload balance and classroom utilization. The proposed solution supports multi-department and multi-shift scheduling, making it scalable for institutions offering undergraduate, postgraduate, and elective courses. Unlike conventional systems that require full timetable regeneration for minor changes, the system is designed to support partial modifications and controlled rescheduling, thereby improving flexibility and usability. A user-friendly interface enables administrators to manage users, view timetables, detect conflicts, and perform adjustments efficiently. By automating the scheduling process, the system significantly reduces manual effort, minimizes human errors, and improves operational efficiency. Its modular, web-based architecture allows easy deployment using existing IT infrastructure, ensuring feasibility and cost-effectiveness. The proposed system aims to enhance academic planning, improve stakeholder satisfaction, and provide a practical, scalable, and adaptable solution for modern higher education institutions.

ELOPMENT OF OPTICALLY TRANSPARENT PLANAR ANTENNA FOR MILLIMETRE WAVE BASED WBAN APPLICATION

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Abstract

The rapid development of wearable technology and body-centric communication systems has increased the demand for compact, lightweight, and efficient antennas that can seamlessly integrate with the human body. Wireless Body Area Networks (WBAN) play a vital role in modern healthcare monitoring, fitness tracking, and other wearable applications. In this project, a transparent planar antenna is designed and developed specifically for millimetre-wave WBAN applications. The proposed antenna aims to provide efficient radiation characteristics and adequate bandwidth while maintaining a compact size and lightweight structure suitable for wearable devices. One of the key objectives of this design is to reduce the visual impact of the antenna when integrated into wearable platforms such as smart clothing,s medical sensors, and body-mounted communication devices. To achieve this, transparent conductive materials are utilized in the antenna structure. These materials allow electromagnetic signal transmission while maintaining optical transparency, enabling the

antenna to remain almost invisible when placed on surfaces like glass, plastic, or flexible substrates. This feature makes the antenna highly suitable for applications where aesthetics and user comfort are important considerations. The antenna is designed to operate in the millimetre-wave frequency band, which offers advantages such as high data rates, low latency, and efficient spectrum utilization. These characteristics are essential for WBAN systems that require reliable and high-speed data communication between body-worn devices and external monitoring systems. The planar structure of the antenna further simplifies fabrication and integration into compact electronic devices. The proposed design focuses on optimizing key performance parameters such as return loss, radiation efficiency, bandwidth, and gain while ensuring that the transparency of the antenna does not significantly degrade its electromagnetic performance. Advanced design techniques and suitable substrate materials are considered to maintain a balance between transparency and antenna efficiency. Simulation and analysis are performed to evaluate the antenna's performance in terms of radiation pattern, impedance matching, and operational bandwidth Overall, the transparent planar antenna developed in this project demonstrates a promising solution for next- generation wearable communication systems. Its lightweight structure, compact design, and optical transparency make it an ideal candidate for integration into modern WBAN devices operating at millimetre- wave frequencies. This work contributes to the advancement of unobtrusive and efficient antennas for wearable and body-centric communication technologies.

Numerical Investigation of Passively Rotating Tabs at the 0.5D Optimal Shifted Location for Mach 2.0 Jet Mixing Enhancement

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Abstract

This research presents a realistic numerical assessment of passively rotating tabs positioned at 0.5D downstream of a Mach 2.0 nozzle exit for supersonic jet mixing enhancement. The investigation builds upon the experimental foundation established by Maruthupandiyan and Rathakrishnan, who identified 0.5D as the optimal shifted location for static tabs, achieving a 55% potential core reduction at Nozzle Pressure Ratio (NPR) 3.0. The current work addresses the research gap regarding the augmentation of these shifted configurations through passive rotation, converting steady geometric blockage into unsteady azimuthal forcing without the requirement for external power. Three-dimensional Reynolds-Averaged Navier-Stokes (RANS) simulations were executed using the SST k-omega turbulence model to capture the complex shock-boundary layer interactions. The passive rotation was modelled using a Multiple Reference Frame (MRF) approach at 3000 rad/s, representing the calculated terminal equilibrium velocity for the 4mm/11mm deep groove bearing assembly under aerodynamic loading. Performance was evaluated at two critical regimes: highly overexpanded (NPR 3.0) and correctly expanded (Design NPR 7.824). Numerical results demonstrate that passive rotation significantly enhances mixing efficacy beyond the static baseline. At NPR 3.0, the rotating tab configuration achieved a 23% additional reduction in shock persistence length compared to stationary shifted tabs (1.7D vs. 2.2D). At the design NPR, rotation facilitated a 30% reduction in supersonic core persistence (10D vs. 14D), despite localized peak amplification in the immediate near-field. Analysis of Mach number contours and transverse velocity magnitude plots confirms the primary mechanism to be rotation-induced vortex disruption, which accelerates potential core reduction and promotes more uniform radial entrainment. This design is an easy-to-add part that does not mess with

the engine's power, but it successfully improves the mixing and provides significant suppression of shock-cell structures.

Keywords: supersonic jet mixing, rotating tabs, shock-cell attenuation, passive rotation, Multiple Reference Frame (MRF).

INTELLIGENT BLOOD MANAGEMENT SYSTEM IN CRISIS

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ABSTRACT

Blood donation plays a crucial role in emergency healthcare, yet many hospitals continue to experience shortages due to delayed donor identification and lack of coordination. This survey paper reviews thirty research works focused on intelligent blood management systems using artificial intelligence and machine learning techniques. The study analyzes algorithms such as K-Nearest Neighbor (KNN), ARIMA, ANN, LSTM, CNN-BiLSTM, and Graph Neural Networks for donor matching, blood demand forecasting, and weather-aware travel time prediction. A comparative analysis highlights the strengths and limitations of existing systems and identifies gaps such as lack of integration, limited datasets, and insufficient real time communication. The survey emphasizes the need for a unified platform that combines AI-based matching, forecasting, routing, and automated notification systems to ensure faster and more reliable blood availability during emergencies.

Keywords: Blood Donation, Machine Learning, KNN, Demand Forecasting, Emergency Management, Intelligent Systems.

Improved Accuracy in Detecting Human Stress Based on Sleeping Habits Using Decision Tree Algorithm in Comparison with Random Forest Algorithm

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Abstract

The aim of this study is to improve the accuracy of detecting human stress based on sleeping habits by comparing the performance of the Decision Tree and Random Forest machine learning algorithms. The study evaluates which algorithm provides better predictive performance and reliability in analyzing sleep-related behavioral data associated with stress indicators. The research was conducted using a student sleep pattern dataset obtained from Kaggle, containing 500 records and multiple sleep-related attributes such as sleep duration, study hours, screen time, caffeine intake, and physical activity. The dataset was preprocessed using Python in Google Colab. Categorical variables such as gender and university year were encoded using LabelEncoder, and feature scaling was performed using StandardScaler. Two machine learning models—Decision Tree Regressor and Random Forest Regressor—were implemented to predict sleep quality, which serves as an indicator of stress levels. The dataset was divided into training and testing sets using an 80:20 ratio. Model performance was evaluated using the coefficient of determination (R^2 score) and error metrics such as root mean square error (RMSE). Statistical analysis was performed using IBM SPSS version 26.0 to compare algorithm performance. The experimental results demonstrate that the Decision Tree model achieved a performance score of approximately 74–78%, while the Random Forest model achieved a higher prediction score of approximately 85–88% in estimating sleep quality from behavioural

attributes. The Random Forest algorithm showed better generalization ability due to its ensemble learning approach, which reduces overfitting and improves prediction stability. Statistical analysis confirmed that the difference in performance between the two algorithms was significant at a 95% confidence interval. The study concludes that the Random Forest algorithm outperforms the Decision Tree algorithm in predicting sleep-related stress indicators. With a prediction performance of approximately 85–88%, the Random Forest model demonstrates higher reliability and accuracy for stress detection based on sleep habits. The findings highlight the potential of machine learning approaches in digital health monitoring and stress prediction systems.

Keywords
Decision Tree Algorithm, Random Forest Algorithm, Stress Detection, Sleep Patterns, Machine Learning, Predictive Modeling.

A Smart AI-Based Hybrid Solar-Wind Power Generation with Load Forecasting System

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ABSTRACT

This project presents an intelligent hybrid renewable energy system that integrates solar photovoltaic and wind power generation with an artificial neural network (ANN)–based load forecasting framework to support sustainable and reliable energy management. Due to the inherent intermittency of solar irradiance and wind speed, standalone renewable energy systems often fail to meet demand consistently. The proposed hybrid configuration improves supply reliability by combining complementary renewable sources. To enhance system-level decision-making, a localized load forecasting unit is implemented using an ESP32 microcontroller and an ANN model trained on historical electricity consumption data. The forecasting model captures daily and seasonal demand patterns, enabling proactive assessment of future load requirements. By predicting demand in advance, the system facilitates intelligent alignment between renewable generation and expected consumption, thereby reducing energy mismatch and improving operational efficiency. The integration of demand forecasting with hybrid renewable generation provides a practical approach for sustainable power planning, where generation uncertainty must be managed while maintaining supply continuity. Rather than relying solely on real-time generation, the proposed framework supports data-driven energy management decisions that improve reliability and resource utilization. This work demonstrates how AI-enabled forecasting can strengthen smart renewable energy systems and contribute to sustainable electrical infrastructure.

Keywords: Hybrid renewable energy system, Solar PV, Wind energy, Load forecasting, Artificial Neural Network, ESP32, Smart energy management.

Design and Implementation of IoT-Enabled Hybrid Motor-Driven Flywheel Energy-Assisted Power Generation System

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ABSTRACT

This paper presents the design and implementation of an IoT-enabled closed- loop hybrid motor-driven flywheel energy-assisted power generation system. The proposed system replaces conventional engine-based generators with an electrically driven motor coupled to a flywheel and

generator arrangement. The inverter supplies controlled AC power to the motor, forming a closed-loop energy structure in which mechanical energy is stored in the flywheel and converted back into electrical energy through the generator. The generated output is rectified and stored in a battery system, which subsequently feeds the inverter,thereby creating a regulated energy circulation loop. To enhance operational efficiency and system reliability, sensors are integrated for monitoring motor speed, motor temperature, generator voltage, current, and battery parameters. A microcontroller-based control unit processes real-time data and performs intelligent decision-making for speed regulation, thermal protection, and overload prevention. An IoT interface enables remote monitoring and data visualization through cloud-based platforms, ensuring smart energy management and fault detection. The flywheel mechanism improves power stability by compensating for transient fluctuations and supporting short-duration load demands. Experimental analysis demonstrates improved energy regulation, enhanced system protection, and effective real-time monitoring capabilities. The proposed system offers a sustainable and smart alternative for small-scale distributed power generation and energy storage applications.

Keywords: Flywheel energy storage, Closed-loop system, IoT monitoring, Inverter control, Hybrid power generation, Energy management.

An Explainable Multi-Model Ensemble learning for Skin cancer Diagnosis

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Abstract:

It is very important to find skin cancer early so that fewer people die and patients get better care. Deep learning has a lot of potential for automating the analysis of skin lesions, but most current methods only use image data and are hard to understand, which makes them less useful in clinical settings. In this study, we introduce a multimodal explainable AI framework that integrates clinical images with patient metadata to enhance the accuracy of skin cancer classification. We use Swin Transformer and DenseNet-169 to analyze images and find both global contextual patterns and detailed convolutional features. When it comes to clinical data, CatBoost and XGBoost are good at modeling structured patient data. Our tests show that Swin Transformer and CatBoost are better than other models in their own fields. Grad-CAM is used on DenseNet-169 to show how image- based predictions work, and SHAP is used to figure out how each clinical feature affects the prediction. This makes things clearer and builds trust in the medical field. We use the PAD- UFES-20 dataset to test the framework. This dataset has pictures taken with smartphones and information about the patients. The results show that combining multimodal learning with explainable AI makes the system more accurate and clear for making clinical decisions.

STELLAR SPACE WEATHER MONITORING AND INTERPRETATION PLATFORM FOR EARTHLINGS

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ABSTRACT

Space weather events such as solar flares, geomagnetic storms, and coronal mass ejections significantly influence satellite communication, navigation systems, and Earth's magnetic environment. However, the complex scientific representation of these phenomena often makes them difficult for students and general audiences to understand. This paper presents "Stellar Stories", an

interactive space-themed storytelling platform designed to transform real-time space weather data into engaging educational narratives. The system integrates external scientific data sources with modern web technologies to create a visually rich and informative learning environment. The platform is developed as a full-stack web application using Vue for the frontend interface and Tailwind CSS for responsive styling. The backend is implemented using the Django REST framework, which manages business logic, API routing, and data processing. A PostgreSQL database is used for efficient storage and retrieval of user profiles, bookmarked stories, and cached event data. Real-time space weather information is retrieved from NASA Open APIs, including the Astronomy Picture of the Day (APOD) API and the DONKI API, which provide solar flare and geomagnetic storm data. To enhance visualization and user engagement, the system incorporates CesiumJS to render a dynamic 3D Earth model where users can observe the impact of space weather events. Character-based storytelling logic translates scientific events into narrative explanations, enabling improved understanding of complex phenomena. The system architecture supports scalable deployment in a production server environment, ensuring reliable performance and accessibility. The proposed platform demonstrates how modern web technologies and open scientific data can be combined to create an effective educational tool for space science learning.

Keywords: Space Weather, Web Application, Django REST API, 3D Earth Visualization, NASA API, Educational Platform, Storytelling System.

Smart Civic Complaint Management System

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ABSTRACT

Urban areas are experiencing rapid growth in population and infrastructure, which has resulted in an increasing number of civic issues such as improper waste disposal, damaged roads, water supply problems, drainage blockages, and malfunctioning street lighting. Efficient management of these issues is essential for maintaining the quality of life of citizens. However, in many municipalities, the process of reporting and resolving civic complaints is still handled through traditional methods such as visiting government offices, making phone calls, or submitting written applications. These methods are often inefficient, time-consuming, and lack transparency, leading to delays in resolving public issues. To address these challenges, this paper proposes the development of a Smart Civic Complaint Management System that provides a centralized digital platform for citizens to report civic problems easily and efficiently. The system allows users to submit complaints by selecting relevant sectors such as waste management, electricity, water supply, road maintenance, sanitation, and drainage. Each complaint is recorded in a centralized database and is automatically forwarded to the appropriate municipal department responsible for resolving the issue.The proposed system also enables users to track the status of their complaints, thereby improving transparency and accountability in the complaint resolution process. Administrators and municipal officials can monitor complaints through an administrative dashboard, categorize them based on priority, and assign them to relevant departments for timely action. In addition, the system stores complaint data that can be analyzed to identify recurring problems, enabling authorities to make data-driven decisions for better urban planning and infrastructure improvement. By digitizing the civic complaint management process, the system aims to improve communication between citizens and government authorities while reducing response time and administrative workload. The Smart Civic Complaint Management

System contributes to the development of smarter cities by promoting citizen participation, improving service efficiency, and supporting better governance. Future enhancements such as mobile application integration, location-based complaint reporting, and artificial intelligence-based complaint classification can further enhance the effectiveness of the system.

Multifunctional Fiber Metal Laminates with Embedded Sensing and Structural Health Monitoring Capabilities

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Abstract

Modern engineering structures increasingly demand materials capable of performing multiple functions beyond load bearing. Fiber metal laminates provide an attractive platform for integrating sensing technologies that enable real-time monitoring of structural integrity. This review explores the development of multifunctional FML systems incorporating embedded sensing networks designed for structural health monitoring (SHM). Various sensing approaches—including fiber optic sensors, piezoelectric transducers, carbon-based conductive networks, and printed electronics—are examined for their ability to detect strain localization, crack initiation, and impact damage within laminate structures. The review discusses the influence of sensor integration on laminate stiffness, interfacial bonding, and overall mechanical performance. Particular emphasis is placed on advanced sensing strategies that enable distributed monitoring across large structural components. Data acquisition and signal processing techniques used to interpret structural response signals are also reviewed. Recent advances in wireless sensing technologies and machine learning-based data analytics are highlighted as emerging tools for intelligent monitoring systems. Despite significant progress, several challenges remain, including sensor durability under cyclic loading, signal noise management, and scalable manufacturing of sensor-integrated laminates. Future developments are expected to focus on integrated digital twin frameworks in which real-time sensor data are coupled with predictive models to enable proactive maintenance and improved operational safety. Such multifunctional laminates have the potential to transform structural materials into intelligent systems capable of self-diagnosis and adaptive response.

Keywords: Structural health monitoring; Smart composites; Fiber metal laminates; Embedded sensors; Intelligent materials

An Intelligent student mentoring and personalized learning guidance platform using machine learning and conversational AI

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ABSTRACT:

Student success in higher education is increasingly influenced by multiple academic,

behavioural, and personal factors. Identifying students who are at academic risk and providing timely guidance remains a major challenge for educational institutions. Traditional academic monitoring methods often rely on manual evaluation and fail to provide personalized support or career direction to students. To address these challenges, this research proposes an AI-driven intelligent student support system that integrates ensemble machine learning, career recommendation analytics, and conversational AI to improve academic performance monitoring and career decision-making. The proposed system consists of two major user modules: teacher module and student module. In the teacher module, academic performance data such as grades, attendance, and student activity records are analysed using ensemble learning techniques including Random Forest, Gradient Boosting, and Support Vector Machines to identify students who are academically at risk. The system generates predictive analytics and visual dashboards that allow teachers to monitor student performance trends and take early intervention measures. The student module focuses on personalized career guidance and skill development. Students upload academic documents, certificates, project portfolios, and specify their interests and career preferences. Based on these inputs, the system computes a career suitability score and recommends relevant career domains, skill requirements, portfolio suggestions, and potential job roles. The system also integrates curated job portals and provides direct application links to help students explore career opportunities aligned with their profiles. To further enhance personalization, a conversational AI chatbot is incorporated to interact with students, understand their academic challenges, and refine recommendations over time. Additionally, an AI-powered virtual teaching assistant (avatar) is integrated to provide topic explanations and learning support when students experience difficulty in understanding specific subjects or concepts. The proposed system combines predictive analytics, recommendation systems, and intelligent interaction mechanisms to create a comprehensive educational support platform. By integrating risk prediction with career guidance and personalized mentoring, the system aims to improve student engagement, reduce academic failure risks, and assist students in making informed career decisions. This research contributes to the development of next-generation intelligent educational support systems aligned with the vision of Industry 5.0, where artificial intelligence augments human decision-making and supports personalized learning experiences in higher education.

Intelligent Traffic Control System for Ambulance Priority

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ABSTRACT

Traffic congestion in the city may cause severe delays in the passage of emergency vehicles such as ambulances, fire trucks, and police vans. Such delays may prove life-threatening in critical situations. Therefore, in order to overcome the problem of delayed passage of ambulances in the city, LIFEFIRST- Intelligent Traffic System for Ambulance Priority is proposed in this project. The Intelligent Traffic System for Ambulance Priority is based on the integration of sound sensors and ESP32-CAM modules. The output of the ESP32 modules is then communicated using an MQTT communication protocol. The signal is then turned green using an Arduino Mega microcontroller. The proposed system includes Fast Fourier Transform (FFT) for recognizing the audio, Edge Impulse-based AI models for ambulance detection in images, and IoT for communication. The experimental results show that the proposed system enhances response time and accuracy in detection, thus improving public safety.

Performance Analysis of Luffa Based Hybrid Helmet

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Abstract

Hybrid composite materials have attracted considerable attention for industrial safety applications due to their high strength-to-weight ratio, improved mechanical performance, and potential for sustainable material development. This project focuses on the design, fabrication, and performance evaluation of a luffa-based hybrid composite helmet reinforced with natural and synthetic fibres. The composite laminate is developed using luffa fibre, coconut leaf sheath fibre, and glass fibre as reinforcements with general-purpose polyester resin as the matrix material. Natural fibres such as luffa and coconut fibre are lightweight, biodegradable, non-abrasive, and cost-effective, making them promising alternatives to conventional synthetic materials.The composite composition consists of 50 wt.% polyester resin, 30 wt.% luffa fibre, 15 wt.% coconut leaf sheath fibre, and 5 wt.% glass fibre. The helmet is designed using CATIA V5 software and fabricated through a moulding process. To evaluate its suitability for industrial safety applications, the fabricated helmet is subjected to penetration, flammability, and shock absorption tests in accordance with industrial safety helmet standards. The results demonstrate that the developed hybrid composite helmet provides satisfactory impact resistance, improved energy absorption, and lightweight characteristics, indicating its potential as a sustainable and cost-effective material for industrial safety helmet applications.

REGIONAL LANGUAGE TRANSLATOR

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Abstract

The Regional Language Translator is an AI-based web application designed to reduce language barriers by enabling users to translate digital content into multiple regional languages efficiently. In multilingual countries such as India, a large portion of the population prefers accessing information in their native languages. However, most digital resources, websites, and educational materials are primarily available in English, which creates difficulties for individuals who are not fluent in the language. The proposed system aims to bridge this communication gap by providing an intelligent translation platform capable of processing different types of input formats. The system supports translation of text, images, and voice inputs, allowing users to interact with the platform using convenient methods. Users can directly enter text, upload images containing printed content, or speak through a microphone for voice translation. Optical Character Recognition (OCR) technology is used to extract text from images, while speech recognition technology converts spoken words into text. The extracted content is then processed through an AI-based translation engine that converts the input into the selected regional language. The application is developed using modern web technologies such as Next.js, React, TypeScript, and Web Speech API, ensuring a responsive and interactive user interface. The system architecture is designed to support efficient data processing,

scalability, and fast response times. By integrating translation, text extraction, and speech processing into a single platform, the Regional Language Translator enhances accessibility to digital information and promotes effective multilingual communication. This system provides a practical solution for overcoming language barriers in education, digital communication, and information sharing across diverse linguistic communities.

Comparative Analysis of 2-Barrier Exponentially Damped Model using Resonant Tunneling Diode with 3-Barrier Lorentzian Damped Model

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ABSTRACT:

This study compares the performance of a 3 barrier Lorentzian damped resonant tunneling diode with a 2 barrier exponentially damped diode in terms of peak current, bias voltage.The analysis of resonant tunneling diodes (RTDs) was conducted using the NanoHub simulation software, specifically utilizing the Resonant Tunneling Diode simulation with Non- Equilibrium Green's Function (NEGF) tool.Specifically the 2 types of RTD devices are investigated for analyzing the material properties for future electronic application. The input parameters of all the devices are fixed The lattice constant was 0.2833 nm, the ambient temperature was 300k, and the starting bias was 0 volts. The ending bias voltage was 0.5 volts for the Reservoir Relaxation model with an Exponentially Damped Model setting. Conversely, the Reservoir Relaxation Model for the three-barrier device was configured using a Lorentzian Damped Model. A comparison of the two Models is done with SPSS software.The output analysis reveals significant differences between the 2-barrier exponentially damped model and the 3-barrier Lorentzian damped model. In the 2-barrier exponentially damped model, the peak current reaches 8114.93 A/cm² at a bias voltage of 0.5.Conversely, the 3-barrier Lorentzian damped model exhibits a peak current of 5233.76 A/cm² at the same 0.5 bias voltage.The Lorentzian damped model of a single barrier device is better than the exponentially damped model based on the peak current and transmission coefficient study.

PERFORMANCE STUDY OF AUTOMATED BOTTLE FILLING AND CAPPING MACHINE

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ABSTRACT

This project presents a performance study of an automatic bottle filling and capping machine designed to improve efficiency in liquid packaging industries. In many industries, bottle filling is done manually, which requires more manpower and may lead to errors in filling quantity. The proposed system uses a flow sensor to measure and control the quantity of liquid during the filling process. It can handle bottles of different capacities and ensures accurate filling according to the required level. After the filling process, the bottle is automatically moved to the capping section where the cap is properly closed. The performance of the system is evaluated based on parameters such as filling accuracy, time taken for filling, and overall efficiency. This automated system helps

reduce human effort, minimize errors, and improve productivity in bottle packaging operations.

Food Calorie Prediction Enhancement

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Saranathan college of engineering

Abstract

This abstract summarizes the limitations and areas for improvement in food recognition and calorie estimation models. Current models often have a limited scope, focusing primarily on food recognition or ingredient extraction, which can lead to inadequate calorie estimation, portion size determination, and dietary-specific information. Additionally, these systems face challenges with data quality, resulting in decreased accuracy and generalizability across diverse real-world food presentations. The lack of end-to-end solutions hampers comprehensive dietary assessments, as many systems require manual pre-processing. Furthermore, existing models often suffer from optimization issues, leading to inconsistent performance with new food items or varying environments. To enhance these models, several areas for improvement are identified. Developin comprehensive dietary analysis capabilities is essential, enabling accurate foo recognition, ingredient identification, portion size estimation, and nutritional value calculation, including allergen flags. Strengthening robustness against real-world data variations is critical, allowing models to efficiently process imperfect images without extensive manual intervention. Integrated, real-time systems that seamlessly connect food image capture with analysis and dietary tracking applications are necessary for immediate feedback. Additionally, expanding datasets to include a wider variety of cuisines and scenarios will improve model accuracy. Lastly, continuous optimization of architectures and parameters is vital for efficient performance, especially on mobile devices.

Predictive Modeling of Vehicle Emissions and Driver Behaviour: An Integrate Approach

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Abstract

Vehicular emissions are a major contributor to air pollution and global climate change, making accurate prediction and analysis essential for sustainable transportation planning. This study focuses on predictive modelling of vehicle emissions and driver behaviour using the Canada Fuel Consumption Ratings dataset collected from 2020 to 2024. The primary objective of this research is to improve the prediction of CO_2 emissions, CO_2 rating, and smog rating by applying advanced machine learning techniques. In this study, multiple machine learning models are implemented to analyse emission patterns and vehicle performance factors. A Decision Tree Regressor is used for predicting CO_2 emissions, a Random Forest Classifier is applied to classify smog ratings, and a Support Vector Machine model is used for predicting CO_2 ratings. These models help identify the key factors influencing vehicle emissions and provide insights into the relationship between fuel consumption, vehicle characteristics, and environmental impact. The proposed predictive framework highlights the role of vehicle emissions in environmental degradation and provides valuable insights that can assist policymakers and urban planners in designing effective emission control strategies and sustainable transportation policies. Furthermore, the analysis of driving behaviour in relation to emission ratings can contribute to safer driving practices and environmentally responsible transportation. The findings of this study support efforts to reduce air pollution and improve overall air quality through data-driven

decision making.

ADAPTIVE EDGE INTELLIGENCE FRAMEWORK FORPREDICTIVE DIAGNOSTICS IN SMART INDUSTRIAL ENVIRONMENTS

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ABSTRACT

Predictive diagnostics is essential for improving the reliability and efficiency of modern industrial systems. This paper presents an Adaptive Edge Intelligence Framework for predictive diagnostics in smart industrial environments. The proposed system collects real-time sensor data such as temperature, vibration, and operational parameters from industrial machines and processes it locally at the edge using embedded devices. Lightweight machine learning–based anomaly detection techniques are employed to analyze sensor data and identify abnormal patterns that indicate potential machine faults. By performing data processing at the edge, the system reduces latency, minimizes dependency on cloud infrastructure, and enables faster decision-making. The proposed framework is scalable, cost-effective, and suitable for real-time industrial monitoring. It supports proactive maintenance, reduces unexpected downtime, and enhances the overall reliability of industrial machinery. Experimental observations demonstrate that the system effectively improves predictive maintenance capabilities in smart industrial environments.

PREDICTIVE MAINTENANCE FOR SMART MANUFACTURING USING AI

GRISHMA SREE VAKA,M.YAMINI,V.PUSHPIKA,S.SRI LALITHA
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ABSTRACT :

The main objective of this paper is to find the best solution for the smart industries to work longer without failure of machinery. It increases efficiency of operational machinery .We are choosing a strategy called predictive maintenance with advancement of AI. Currently industries are becoming more automated (using smart technology) which is already a large investment .Spending alot on machinery and facing a downfall due to its failure is a big ban and leads the industries to shutdown. There are some traditional methods (reactive and predictive maintenance) to escape from the situation, they are just escaping ideas, but not the ideal solutions. o Reactive maintenance: According to this strategy , the initiative is taken after the failure of the machines. This is not ideal as the loss is irretrievable. o Preventive maintenance: This is the method where machinery is serviced at regular time periods. This leads to unnecessary investment on preliminarily good equipment. We chose predictive maintenance inorder to solve this problem in an optimal way.

Methodology to predict the machine failures before they happen:

1. MACHINE LEARNING ALGORITHM
2. DEEP LEARNING METHODS
3. IOT FOR SENSORS

Finally through this approach we can see increase equipment's lifetime in smart factories. More efficiency, more output, more profit.

A smart wearable for speech impaired and post surgery patients with iot

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ABSTRACT :

Due to their limited mobility and vocal limitations, paralysed individuals frequently struggle with communication and health monitoring. This work introduces an Internet of Things (IoT)-based system that combines continuous health monitoring with a sensor-based smart glove to enhance patient care. The glove detects falls, sends emergency messages via hand gestures, and monitors vital indicators, including SpO2, heart rate, and body temperature. The smart glove uses Arduino UNO (RoboCraze, Bengaluru, India) and ESP8266 (RoboCraze, Bengaluru,
India) modules with MPU6050 (RoboCraze, Bengaluru, India), MAX30100 (RoboCraze, Bengaluru, India), LM35 (Bombay Electronics, Mumbai, India), and flex sensors for these functions. MPU6050 detects falls precisely, while MAX30100 and flex sensors measure gestures, SpO2, heart rate, and body temperature. The flex sensor interprets hand motions as emergency alerts sent via Wi-Fi to a cloud platform for remote monitoring. The experimental results confirmed the superiority and validated the efficacy of the suggested module. Scalability, data logging, and real-time access are guaranteed by IoT integration. The actual test cases were predicted using a Support Vector Machine, achieving an average accuracy of 81.98%.

Vehicle And Passenger Safety from Confined Water Logging

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Abstract:

Urban areas experience severe waterlogging problems which create major challenges because they pose risks to public health and impede transportation systems. The traditional methods used for drainage monitoring do not function effectively because they lack capability to detect problems in advance and observe ongoing conditions. The system utilizes distributed architecture which gathers environmental data through IoT-based sensors that include water level sensors and rainfall detection systems to assess high-risk areas of cities. The system uses physical sensors together with computer vision techniques which employ YOLO (You Only Look Once) object detection models including YOLO v1, v2, v3, v4 and v5 to analyse video streams captured from monitoring cameras. The models provide capabilities for immediate flood detection and water depth measurement. The proposed system integrates a Raspberry Pi–based embedded platform which processes sensor data and camera footage to identify vehicles that have become stuck in flooded regions. The system uses ultrasonic sensors to measure water levels while it classifies risk levels into three categories which show safe conditions and warning conditions and critical conditions. This study uses deep learning object detection methods to analyse images from flooded areas in order to detect abandoned vehicles and identify situations that put passengers at risk. The detection performance evaluation utilizes various YOLO model variants to test captured frames under multiple environmental scenarios which include rain and reflections and partial occlusions. The Particle Swarm Optimization (PSO) technique is used to optimize model hyperparameters including learning rate and detection threshold and anchor box parameters in order to enhance detection accuracy and reliability. The system performance assessment uses standard metrics which include detection accuracy and precision and recall and F1-score and processing latency to assess its real-time monitoring capability. The framework includes GPS and GSM communication modules which automatically send emergency alerts and location data when it detects critical flooding conditions. The experimental results show that the intelligent monitoring system provides reliable flood detection in real time while enhancing passenger safety and emergency

response efficiency in urban waterlogged environments.

Keywords— Computer vision, IoT sensors, Deep Learning, YOLO v1, v2, v3, v4, and v5.

AI-Driven Zero Trust Architecture for Real-Time Threat Detection in Software Defined Enterprise Networks

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Abstract:

The rapid growth of cyber threats and the widespread adoption of hybrid and cloud-based infrastructures have exposed the limitations of traditional perimeter- based security models. Zero Trust Architecture (ZTA) has emerged as an effective security paradigm that enforces continuous verification of users, devices, and network traffic, ensuring that no entity is trusted by default. This paper presents an AI-integrated Zero Trust Architecture for enterprise networks designed to enhance real-time threat detection and dynamic access control. The proposed framework leverages Software Defined Networking (SDN) with a Ryu controller for centralized network management and uses Mininet to simulate a virtual enterprise network environment. Network traffic features such as source and destination IP addresses, ports, protocol types, and packet lengths are extracted and analyzed using a machine learning-based Intrusion Detection System implemented with a Random Forest classifier to classify traffic as benign or malicious in real time. Based on AI predictions and predefined security policies, a Zero Trust Policy Engine dynamically installs OpenFlow rules to allow or block suspicious traffic. Experimental evaluation demonstrates improved threat detection accuracy and faster mitigation of malicious activities, thereby strengthening enterprise network security and reducing the attack surface.

Poultry connect -An AI and IoT-Based Smart Poultry Farming System for Reducing Mortality and Enhancing Rural Livelihoods

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Abstract:

Poultry farms are highly susceptible to disease outbreaks that cause significant economic losses due to delayed identification of early symptoms. Conventional monitoring systems rely on manual observation or threshold-based alerts, which fail to capture subtle behavioral and environmental variations that precede visible illness. *This project proposes an AI-enabled intelligent poultry health prediction system that integrates IoT sensing with a Transformer- based multimodal learning model for early disease detection.* The system continuously acquires environmental parameters such as *temperature, humidity, and ammonia levels along with behavioral and acoustic signals* from birds using distributed sensors and vision modules. The collected data are preprocessed and converted into time-series feature sets. A *hybrid AI framework* is implemented where *baseline machine learning models (Random Forest and Support Vector Machine) are used for preliminary classification, and a Transformer model is employed to capture long-range temporal dependencies and interactions among multiple parameters for early prediction of abnormal patterns associated with diseases* such as Newcastle Disease, Avian Influenza, and Infectious Bronchitis. The prediction

results are transmitted through an IoT gateway to a *cloud-connected web application* that provides real-time monitoring, visualization dashboards, and automated alerts for farmers and veterinarians. The proposed system aims to deliver a low- cost, scalable, and deployable decision-support platform capable of identifying early disease signatures before severe symptoms occur. This approach enhances disease surveillance, reduces mortality, improves productivity, and demonstrates the practical application of AI-driven predictive analytics in precision poultry farming.

Rydex(on demand driver hiring web app)

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Vels University.

Abstract:

The On-Demand Driver Hiring Web Application is designed to help car owners hire a driver when they are unable or unwilling to drive. The system connects users, drivers, and administrators on a single web platform, allowing users to book drivers easily while drivers can accept requests online. This web-based solution improves convenience, safety, and efficiency compared to traditional manual driver hiring methods.

Ai powered recruitment assistant for resume screening and interview question generation

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Abstract:

The recruitment process in modern organizations requires evaluating a large number of job applications within a limited time. Traditional manual resume screening is time-consuming, inefficient, and often affected by human bias. To address these challenges, this project proposes an AI-Powered Recruitment Assistant, developed as a Django-based web application that automates resume screening and interview question generation.The system uses Artificial Intelligence (AI) and Natural Language Processing (NLP) techniques to analyze candidate resumes and compare them with job descriptions. Recruiters can upload resumes in PDF or DOC format along with the job requirements. The system extracts relevant information such as skills, education, experience, and certifications using document parsing techniques and structures the extracted data for analysis. An NLP-based skill-matching algorithm evaluates the similarity between candidate profiles and job requirements to calculate a relevance score. Based on this score, candidates are automatically ranked and shortlisted, enabling recruiters to quickly identify suitable applicants and significantly reducing manual screening effort. The Django backend manages authentication, resume processing, job postings, and candidate records while providing an interactive dashboard for recruiters to view shortlisted candidates, skill match percentages,and resume summaries.Additionally, the system generates customized technical, behavioral, and situational interview questions based on the job role and candidate skill set.The proposed solution demonstrates how AI and web technologies can enhance recruitment efficiency and support modern talent acquisition processes.

IoT Based smart medicine dispenser for chronic illness management

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Abstract:

Correct on-time medication is very important to recover from the health problem. This paper aims to develop a medicine dispenser system. Taking medicines for elderly, deaf, and blind people is difficult without any attendant around. The designed system helps to remind them to take their medicines and delivers the medicine according to the prescription. The system has three medicine delivery parts one for the morning, one for the afternoon, and one for the night. The pills are put in the boxes according to the prescription and delivered automatically based on the input from a real-time clock (RTC) at appropriate timings. The system uses a microcontroller to control various operations. It senses the input signal from RTC and gives a control signal to the servo motor to actuate dispensing the box containing pills. The provision is made to give an alarm to the patient through voice message and LCD displays to remind the patient to take medicine. A mobile app is developed using the Cayenne mobile app developer so that the caretaker will get a live notification at his or her workplace. This ensures the caretaker that the patient has taken the medicine. The system has the facility to store medicine for seven days. The scheduling and modification can be done through the mobile app according to the prescription. The prototype has been developed and tested. The System is working satisfactorily.

Data Analytics for Women Safety Crimes in India

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Abstract:

Women safety has become a significant social concern in India due to the increasing number of crimes reported against women across different regions and time periods. Crimes such as assault, kidnapping, rape, and harassment continue to threaten the safety and well-being of women in society. Understanding crime patterns and identifying high-risk areas is essential for improving public safety and supporting informed decision-making by authorities and policymakers. This research presents a data-driven analytical framework for studying crimes against women in India using data preprocessing, database management, and visual analytics techniques. The proposed system utilizes crime datasets collected from publicly available sources such as Kaggle, which contain records related to different crime categories, states, districts, and years. Python is used for data preprocessing to clean, organize, and standardize the raw datasets. During this process, missing values are handled, column formats are standardized, and irrelevant records are removed to ensure data consistency and accuracy. After preprocessing, the cleaned datasets are stored and managed using MongoDB Compass, a NoSQL database tool designed for handling large and semi-structured datasets. The organized dataset is then imported into Microsoft Power BI for analytical processing and visualization. Power BI dashboards are developed to provide interactive visual representations of crime data. These dashboards present key insights such as total crime incidents, crime type distribution, top crime-prone areas, state-wise crime counts, and women safety risk zones. Geographical visualizations such as crime hotspot maps help identify unsafe regions and highlight areas where crimes against women occur more frequently. The results demonstrate that data analytics and visualization techniques can effectively transform raw crime datasets into meaningful insights. The proposed system helps in identifying crime trends, understanding regional safety variations, and providing a clearer view of women safety challenges across India. Overall, the proposed analytical framework provides a practical approach for analyzing crimes against women using modern data

analytics tools. The insights generated through this system can support researchers, policymakers, and social organizations in understanding crime patterns and identifying unsafe regions.

RAG-Based NLP Framework for Intelligent Legal Query Resolution in Indian Criminal Laws

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Abstract:

The rapid transformation of criminal law in India, particularly with the introduction of new legal codes, has created a growing demand for systems that can provide clear and reliable legal information. Legal documents are generally written in complex and technical language, which makes it challenging for ordinary citizens and individuals without legal training to understand their rights, duties, and legal procedures. To address this issue, this project proposes a Retrieval-Augmented Generation (RAG) based Natural Language Processing framework designed to answer legal queries related to Indian criminal law. The proposed system combines document retrieval methods with advanced language models to produce context-aware responses based on authoritative legal sources. Important legal documents such as the Bharatiya Nyaya Sanhita, Bharatiya Nagarik Suraksha Sanhita, and Bharatiya Sakshya Adhiniyam are processed and stored in a vector database to enable semantic search. When a user submits a legal question, the system retrieves the most relevant legal provisions and generates simplified explanations that are easier for users to understand. By grounding generated responses in verified legal documents, the system
helps reduce incorrect or misleading outputs produced by language models. This improves the factual reliability and transparency of AI-assisted legal guidance. The proposed framework aims to build an efficient and scalable legal information platform that can later be extended to support multilingual interaction and voice-based query systems.

A Federated ConvLSTM-Based Multi-Task Learning Framework for Flood Occurrence, Severity, and Timing Prediction

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RAMCO INSTITUTE OF TECHNOLOGY.

Abstract:

Floods are among the most destructive natural disasters, causing significant damage to human life, infrastructure, agriculture, and the environment. With the increasing impact of climate change and extreme weather conditions, the frequency and intensity of floods have increased, making accurate and early flood prediction essential for effective disaster management and early warning systems. Traditional flood prediction models often focus on single-output forecasting and struggle to capture the complex spatial and temporal patterns present in environmental data such as rainfall, river flow, and weather parameters. To address these challenges, this research proposes a Federated ConvLSTM-based Multi-Task Learning framework for predicting flood occurrence, flood severity, and flood timing simultaneously. The proposed system integrates XGBoost for analyzing structured environmental data and ConvLSTM to capture spatio-temporal dependencies in hydro-meteorological time-series data. The dataset undergoes preprocessing steps including data cleaning, normalization, and time-series structuring before model training. The performance of the model is evaluated using

metrics such as Accuracy, F1- score, and Root Mean Square Error (RMSE). Experimental results indicate that the integrated approach improves prediction reliability compared to traditional methods. The proposed framework can support disaster management authorities by enabling early flood warnings and improving flood risk assessment and preparedness.

Customer Churn Prediction Using Random Forest Classification and Power BI Visualization

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Abstract:

Customer churn is a major challenge for organizations, particularly in the telecommunications industry where retaining existing customers is more cost-effective than acquiring new ones. Predicting customer churn in advance allows companies to identify customers who are likely to discontinue their services and implement effective retention strategies. This study presents an integrated customer churn analysis and prediction framework that combines SQL-based data preprocessing, Power BI visualization, and machine learning techniques. Initially, telecom customer data is stored in a SQL database where preprocessing operations such as handling missing values, data cleaning, and transformation of categorical attributes are performed to ensure data consistency and quality. Exploratory data analysis is conducted using SQL aggregation queries to identify patterns in customer behavior and churn distribution. The processed dataset is then imported into Power BI to create interactive dashboards that provide insights into customer demographics, contract types, service usage, revenue patterns, and churn trends. These dashboards help organizations understand important business metrics and identify high-risk customer segments. For predictive analysis, a Random Forest classification model is implemented using Python to predict whether a customer is likely to churn. The model is trained using customer attributes such as contract type, total revenue, monthly charges, tenure, and service usage features. The model performance is evaluated using several metrics including confusion matrix, classification report, accuracy, and Receiver Operating Characteristic (ROC) curve. Experimental results demonstrate that the Random Forest classifier achieves approximately 84% prediction accuracy with an AUC score of 0.88, indicating strong predictive capability in distinguishing churned customers from retained customers. Furthermore, a Flask-based web application is developed to allow users to input customer information and obtain churn predictions interactively. The proposed system integrates data preprocessing, visualization, machine learning, and web deployment to provide a practical and scalable solution for customer churn prediction, enabling organizations to make data- driven decisions and improve customer retention strategies. This approach demonstrates how integrating data analytics, machine learning, and visualization tools can support organizations in improving customer retention and business decision-making.

Real-Time Hotel Management Chatbot using AWS Lex, AWS Lambda and Cloud Services

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Ramco Institute of Technology.

Abstract:

The hospitality industry is increasingly adopting intelligent automation technologies to improve customer service and operational efficiency. This project presents the design and

implementation of a Real-Time Hotel Management Chatbot using Amazon Web Services (AWS), integrating services such as AWS Lex, AWS Lambda, Amazon DynamoDB, Amazon Simple Email Service (SES), and Amazon S3 to build a scalable serverless chatbot system. The proposed chatbot acts as a virtual hotel assistant that enables users to perform hotel-related operations through a conversational interface. Users can check room availability, book rooms, view reservations, cancel bookings, and obtain general hotel information. The conversational interface is powered by AWS Lex, which uses natural language understanding to interpret user queries and identify user intents.

Backend processing is handled by AWS Lambda, which executes the business logic and interacts with Amazon DynamoDB to store and retrieve booking information. Two main database tables are used: RoomInventory for managing room availability and HotelBookings for storing reservation details. Additionally, Amazon SES is integrated to send automated email notifications for booking confirmations and cancellations. The chatbot interface is deployed as a web application hosted on Amazon S3, enabling users to interact with the system in real time through a browser-based chat interface. The overall system follows a serverless architecture, providing scalability, cost efficiency, and reduced infrastructure management. This project demonstrates how conversational AI and cloud computing can automate hotel management tasks while enhancing customer engagement and service efficiency.

A Multi-Modal AI-Based Online Exam Proctoring System for Real-Time Cheating Detection Using Computer Vision Techniques

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Saranathan College of Engineering.

Abstract:

Online examinations have become increasingly common with the rapid growth of digital learning platforms. However, ensuring academic integrity and preventing malpractice during remote examinations remains a major challenge. Traditional online examination systems lack effective monitoring mechanisms, making them vulnerable to cheating behaviours such as unauthorized device usage, impersonation, and suspicious activities. Therefore, an intelligent and automated proctoring system is required to ensure fair and secure assessments in remote environments. This research proposes an AI-based online exam proctoring system that utilizes computer vision and machine learning techniques to monitor candidate behaviour during examinations. The proposed system integrates multiple monitoring modules including face detection and recognition, head pose tracking, gaze detection, and keyboard shortcut monitoring to identify suspicious activities in real time. Computer vision algorithms implemented using OpenCV, MediaPipe, and deep learning-based face recognition models analyse webcam video streams to detect anomalies such as multiple faces, absence from the screen, unusual head movements, or attempts to switch applications. The system further incorporates a multi-modal monitoring framework that combines visual and behavioural indicators to evaluate exam integrity. Detected events are logged and analyzed to compute a trust score or risk score, which represents the likelihood of cheating during the examination. This scoring mechanism helps instructors review student performance and identify potential violations efficiently. The proposed solution is implemented using Python with Flask for the web interface, integrating real-time video processing and automated monitoring capabilities. By combining computer vision, behavioural analysis, and automated risk assessment, the system provides an effective and scalable solution for maintaining academic integrity in remote examinations. The proposed framework enhances transparency, reduces manual invigilation efforts, and supports secure online assessments in modern digital learning environments.

AI Fraud Call Detection

Vemuri S.V.R Sai Nikhil,S.V.S Giridhar,U.Veerakoushik.
Sri Chandrasekharendra saraswathi viswa maha vidyalaya.

Abstract:

Fraud calls have become very common in recent years where attackers pretend to be bank officials, government officers, or customer service agents to steal sensitive information like OTPs, bank details, and passwords. Detecting such calls manually is difficult. This project proposes an Artificial Intelligence based Fraud Call Detection System which automatically analyzes call audio or speech text and identifies whether the call is fraudulent or genuine. The system uses Machine Learning and Natural Language Processing (NLP) techniques to analyze keywords, speech patterns, and conversation context. If the system detects suspicious patterns such as requests for OTP, bank details, or urgent money transfers, it flags the call as a potential fraud and alerts the user.

An Enhanced Deep Learning Approach for Visual Food Spoilage Detection with Interpretability and Agentic AI Support

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Saranathan College of Engineering.

Abstract:

Food spoilage is a major global challenge that contributes to foodborne illnesses, large-scale food wastage, and significant economic losses in households and food industries. Early and reliable detection of food spoilage is therefore essential for ensuring food safety and reducing unnecessary waste. Existing image-based food quality assessment systems primarily focus on binary classification (fresh vs. spoiled) and often lack capabilities such as spoilage severity estimation, prediction confidence evaluation, and interpretability of model decisions. These limitations reduce the reliability and transparency of such systems in real-world applications. To address these challenges, this research proposes an enhanced deep learning-based framework for visual food spoilage detection with interpretability and intelligent decision support. The proposed system utilizes convolutional neural networks combined with transfer learning using Efficient Net architecture to analyse food images and classify them into multiple spoilage severity levels rather than simple binary categories. The system processes food images through preprocessing techniques such as resizing, normalization, and augmentation to improve model generalization and robustness. Unlike conventional approaches, the proposed model provides confidence-based predictions to indicate the reliability of classification results. Furthermore, Explainable Artificial Intelligence (XAI) techniques such as Grad-CAM are integrated to generate visual heatmaps that highlight the specific regions of the image responsible for the model's decision. This interpretability mechanism improves transparency and increases user trust in AI-driven food quality assessment. Additionally, the framework incorporates an Agentic AI decision-support module that interprets model predictions and generates practical recommendations for users, such as whether the food is safe to consume, should be consumed soon, or must be discarded immediately. The system is designed using Python with deep learning frameworks such as TensorFlow/Keras and image processing techniques implemented through OpenCV, enabling efficient training and deployment. By combining multi-level spoilage classification, confidence

estimation, explainable AI, and intelligent recommendations, the proposed system provides a reliable and transparent solution for automated food spoilage detection. This approach enhances food safety monitoring, supports consumer and industry decision-making, and helps reduce food waste through AI-based food quality assessment.

15-Minute Smart Meter Electricity Consumption and Billing Analysis

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Abstract:

Deploying smart meters in modern electricity systems has led to generating large amounts of high- frequency energy consumption data. Traditional data processing methods cannot efficiently store and analyze such massive datasets. This research presents a big data analytics framework for examining smart meter electricity consumption and estimating billing using short-interval data. Smart meter datasets from two cities for the years 2019, 2020, and 2021 were processed using a distributed big data system. The Hadoop Distributed File System (HDFS) provided scalable storage, Hive was used for structured data warehousing, and Apache Spark handled large-scale data processing and aggregation. Electricity readings were aggregated into 15-minute intervals, which is a standard time frame for electricity load analysis. We performed analytical operations like hourly consumption analysis, demand pattern identification, and abnormal meter detection. The processed data was then visualized using Power BI dashboards, where electricity consumption and billing estimates were generated for every 15-minute interval. The dashboards allow users to monitor short-interval electricity usage, calculate estimated electricity bills based on 15-minute consumption, and identify peak usage periods. Additional dashboards provide monthly billing summaries and demand insights for electricity departments to analyze peak load behavior. The results demonstrate that integrating big data technologies with 15-minute smart meter analytics improves electricity monitoring, billing transparency, and demand analysis for more efficient energy management.

Encrypted Image Steganography using AES and LSB Technique

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Abstract:

With the rapid growth of digital communication, protecting sensitive information has become increasingly important. Conventional encryption techniques protect the content of a message but often reveal the presence of encrypted data. Steganography addresses this limitation by concealing the existence of the message itself within another digital medium. This paper presents a secure image steganography system that integrates Advanced Encryption Standard (AES) encryption with Least Significant Bit (LSB) image steganography to ensure both confidentiality and concealment of information. In the proposed approach, the message is first encrypted using AES and then embedded within the pixels of an image using the LSB method. The system also provides a graphical interface that allows users to select an image, enter a message and password, and generate a stego-image with minimal visual distortion. During decoding, the system extracts the hidden bits and decrypts them using the same password. Experimental results demonstrate that the proposed approach successfully

hides encrypted data inside images while preserving image quality. The system provides a practical and secure solution for confidential data transmission.

Enhanced Drug–Drug Interaction Prediction Using Transformer-Based Deep Learning Models

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Vels Institute of Science Technology and Advanced Studies.

Abstract:

Drug–drug interactions (DDIs) occur when two medications interact with each other and alter their expected effects in the human body. Such interactions may lead to reduced drug effectiveness, adverse side effects, or serious health risks. Detecting and understanding these interactions is essential for ensuring patient safety and supporting healthcare professionals in clinical decision-making. Traditional drug interaction checking systems are mainly database- driven and often provide limited explanations about the cause and impact of interactions. This paper proposes a drug interaction prediction and explanation system using deep learning and biomedical natural language processing techniques. The proposed system utilizes BioBERT, a domain-specific language model trained on biomedical text, to analyze drug pairs and predict the type of interaction between them. To enhance interpretability, the system integrates a drug interaction knowledge base that provides clear explanations of the predicted interactions. When a user enters two drug names, the system predicts the interaction type and generates a brief explanation describing the possible cause, potential health effects, and medical advice. A web-based interface developed using the Flask framework allows users to easily input drug names and obtain results. The proposed system demonstrates the potential of artificial intelligence in improving drug safety awareness.

CNN-Assisted Hybrid Multi-Stage Framework for Low-Light Image Enhancement

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Abstract:

Images that are obtained in low-light scenes during surveillance and monitoring usually have bad lighting conditions, poor contrast, and noise pollution and loss of structural features which severely compromises visual perception and automatic analysis of vision. This paper seeks to solve these issues by developing a CNN-aided hybrid multi-stage image enhancement solution, which enhances the scenes during low-light conditions by refining the illumination distribution and structure without negatively impacting the computational performance. The suggested framework combines the utilization of multi-scale contrast optimization, the preservation of residual details, and refinement using CNNs to promote low-light images of poor quality. To begin with, it optimizes multi-scale contrast based on a type of U-Net based approach which utilizes image data at multiple spatial scales to enhance the distribution of illumination. A final residual refinement step then works to refine the structural textures and edge data by boosting the skills on high-frequency components, and averting the artifacts. Lastly, one incorporates a pretrained convolutional neural network (DnC CNN) which will be added as an additional refinement module to remove noise additional and enhance the quality

of the visuals. The experimental analysis of various low-light tests images has shown that the proposed framework outperforms entropy, contrast and brightness stability in comparison to the conventional improvement algorithms like Histogram Equalization (HE) and Contrast Limited Adaptive Histogram Equalization (CLAHE). The efficacy of the suggested methodology in enhancing the level of illumination and structural preservation is further validated with the aid of a visual comparison, histogram analysis, and the use of an intensity profile. Characters the suggested hybrid framework will provide an efficient trade-off of improvement effectiveness and computational efficiency when compared to most deep learning-based models that demand high volumes of training data and computational resources and thus will be applicable to real-time low-light imaging their usage.

AI-Based Automatic Power Factor Correction System Using Adaptive ANN Control

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Abstract:

The growing use of inductive loads in industrial and domestic AC systems has made power quality a critical concern. A low power factor results in increased reactive current, elevated line losses, and financial penalties from utility providers. Conventional Automatic Power Factor Correction (APFC) systems address this through fixed-threshold relay switching of static capacitor banks; however, their lack of adaptive control makes them incapable of handling nonlinear or rapidly changing loads, leading to hunting oscillations, multi-cycle switching delays, and overcompensation. To overcome these limitations, this paper proposes an AI-Based APFC system integrating an Adaptive Artificial Neural Network (ANN) controller on an ESP32 microcontroller with a PZEM-004T energy monitoring module and a three-stage capacitor bank (2 µF, 4 µF, and 6 µF) capable of producing 7 distinct switching combinations to cover a wide range of reactive power compensation levels. The ANN employs the Widrow–Hoff online weight update rule to continuously adapt correction decisions based on real-time PF error, with learned weights persisted to EEPROM across power cycles — eliminating cold-start delays. Anti-oscillation dead-band logic of ±0.02 suppresses relay chatter near unity PF, while dynamic capacitor step-jumping across all 7 relay combinations enables aggressive correction for large errors and fine correction near the target. All relay switching is synchronized to voltage zero-crossings to minimize inrush current and contact wear. The dual-core ESP32 architecture dedicates Core 0 to time-critical ADC sampling and zero-crossing detection, while Core 1 handles ANN inference and IoT telemetry via the Blynk platform. The system was validated through Proteus simulation and a physical hardware prototype across three load conditions — no load, partial load, and heavy load — achieving a corrected power factor of ≥ 0.98 in all cases with a dynamic response time of 40 ms, significantly outperforming conventional threshold- based controllers. Pre- and post-compensation waveforms confirm near-unity phase displacement following capacitor switching. The system's low cost, compact design, EEPROM-persistent ANN, and built-in Wi-Fi make it suitable for domestic and small industrial deployments, with future scope in LSTM-based predictive correction and thyristor-controlled reactors for continuous reactive power compensation.

Vehicle black box system for accident avoidance and post crash analysis using IOT

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Kings college of engineering.

Abstract:

Road accidents remain a major global concern, causing significant loss of land property. To improve vehicular safety and accident monitoring, this project proposes a low-cost, real-time vehicle monitoring and accident alert system integrated into a compact black box design. The system is built around a PIC microcontroller that interfaces with multiple sensors to detect accidents, monitor vehicle components, and assess driver alertness. In the event of a collision, the system activates an alarm and uses GPS and IOT technologies to send the vehicle's real- time location to the owner's relatives and nearby emergency services for faster rescue respond. To support accident monitoring and post-crash investigation, three camera modules are installed in the vehicle. One camera is mounted on the front mirror facing the driver to monitor driver behavior, another is placed behind the driver's seat to record vehicles approaching from the rear, and the third camera is positioned on the dashboard behind the steering wheel to capture vehicles and obstacles approaching from the front. An alcohol detection sensor installed on the steering wheel column detects alcohol in the driver's breath to help prevent drunk driving. The system also includes sensors to monitor vehicle components such as the accelerator, brake, clutch, and steering, along with a driver drowsiness detection module using an eye blink sensor to detect fatigue and provide warnings. A reset switch is included to manage false alerts. All collected data is stored on a cloud platform, enabling real-time tracking, remote monitoring, and historical analysis. This integrated black box system provides both preventive safety measures and post-accident investigation support, and cost-effective solution for life loss.

Design and Development of a 3D Scanning System for Dimensional Measurement and Inspection

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Abstract:

Three-dimensional (3D) scanning technology plays an important role in modern engineering for dimensional measurement, inspection, and product analysis. Accurate measurement of components is essential in manufacturing to ensure that products meet design specifications and maintain quality standards. Conventional measurement tools such as vernier calipers, micrometers, and coordinate measuring machines can be time-consuming and may not be suitable for measuring objects with complex geometries. Therefore, the development of an efficient and affordable 3D scanning system has become increasingly important.This study focuses on the design and development of a 3D scanning system capable of capturing the shape and dimensions of physical objects and converting them into digital 3D models. The proposed system consists of a distance sensing module, a microcontroller for system control, stepper motors for controlled movement, and a rotating turntable mechanism. During the scanning process, the object is placed on the turntable and rotated gradually while the sensor measures the distance between the sensor and the object surface at different angles. The collected measurements are stored as coordinate points forming a point cloud that represents the surface geometry of the object.The generated point cloud data is processed using suitable algorithms to reconstruct a three-dimensional model. This model can be used for dimensional measurement, inspection, and comparison with the original design to identify errors or deviations. The developed system provides a low-cost and portable alternative to expensive industrial scanners, making it suitable for educational, research, and small-scale industrial applications.

AI based Outpatient Intelligent Summarizer

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Abstract:

The rapid growth of digital health records in outpatient departments has created a significant challenge for healthcare professionals seeking to efficiently review and utilize patient information within limited consultation time. Outpatient visits often produce large volumes of unstructured clinical data, which includes physician notes, diagnostic reports, prescriptions, and follow-up instructions. This paper presents an Outpatient Intelligent Summarizer, an AI-driven system designed to automatically generate concise, accurate, and clinically relevant summaries from outpatient medical records. The proposed system utilizes natural language processing (NLP) and machine learning techniques to extract key medical entities, including symptoms, diagnoses, medications, laboratory results, and treatment plans. By organizing and prioritizing critical patient information, the summarizer enables physicians to make faster clinical decisions and reduces the time spent on reviewing documentation. Additionally, the system enhances continuity of care by providing easily interpretable summaries for follow-up consultations. Experimental evaluations demonstrate that the intelligent summarizer improves information accessibility, reduces cognitive load on healthcare professionals, and maintains high summarization accuracy. The proposed approach has the potential to enhance outpatient workflow efficiency, improve the quality of patient care, and support the adoption of intelligent clinical decision support systems in modern healthcare environments.

Design of Iot-Enabled Control and Health Monitoring System for an Integrated On-Board Charger in Electric Vehicles

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Abstract:

Designing an Internet of Things (IoT) enabled control and health monitoring system for an integrated onboard charger in electric vehicles is the focus of this document. The system takes advantage of the use of traction inverters and motor windings when charging, therefore reducing required additional power electronics components. This results in a more efficient and less complex system. The IoT based monitoring system continuously measures various parameters such as voltage, current and temperature while charging. These measured values are processed by a microcontroller and communicated to the cloud for real-time monitoring. When abnormal conditions exist, such as over-voltage, over-current or over-temperature, the system will automatically stop charging thus providing protection to the battery and charger from being damaged. Simulation results confirm that the proposed system works as expected

DATA ANALYSIS ON YOUTUBE VIDEO PERFORMANCE AND VIEWER ENGAGEMENT

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Abstract:

The rapid growth of online video platforms has generated a massive volume of user interaction data, creating new opportunities for analyzing viewer behavior and content performance. Among these platforms, YouTube has emerged as one of the most influential video-sharing platforms, where content creators rely on analytics to understand audience engagement and optimize their video strategies. This study focuses on analyzing YouTube video performance and viewer engagement using data analytics and visualization techniques. The dataset used in this research contains key video performance metrics such as views, likes, comments, click-through rate (CTR), average watch duration, keywords, and upload timing. Data preprocessing and analysis were performed using Python libraries including Pandas and NumPy for data manipulation and Matplotlib and Seaborn for visualization. Exploratory Data Analysis (EDA) was conducted to identify patterns and relationships between different engagement metrics. An interactive dashboard was developed using Streamlit to present analytical insights such as CTR by title format, keyword performance, and average views by upload day. The system also includes additional tools such as a Smart Title Tester for predicting potential click- through rate and an AI Title Generator for suggesting optimized video titles. The results demonstrate that factors such as title format, keyword usage, and upload timing significantly influence viewer engagement and video performance. The proposed analytics dashboard helps content creators and digital marketers understand audience interaction patterns and improve their content strategies. Overall, this study highlights the importance of data-driven decision making in digital media platforms and provides a practical analytics framework for evaluating YouTube video performance.

Renewable Energy Monitoring Systems in Rural Areas for Solar and Wind Microgrids

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Abstract:

The Renewable Energy Future Prediction System serves as an analytical tool that continuously monitors, assesses, and predicts energy generation and storage behavior in a hybrid renewable environment. It collects real-time operational data related to energy generation patterns, environmental conditions, and storage performance. The system processes this information using data analysis and machine learning techniques. By combining historical datasets with live inputs, it identifies connections between changes in the environment and energy output trends. Using predictive algorithms, the system estimates future voltage behavior, charging patterns, energy availability, and efficiency changes. This predictive ability helps to understand how shifting environmental factors impact renewable energy performance over time. The system focuses on data- driven decision making, which allows for better energy usage and storage strategies. Through ongoing monitoring and analysis, it reduces uncertainty in renewable energy production and improves reliability. The predictive model adjusts as new data comes in, increasing its forecasting accuracy over time. The main goal is to build a smarter framework for managing renewable energy that not only tracks current performance but also predicts future conditions. By combining monitoring, analytics, and prediction into a single platform, the system aids in efficient energy planning, sustainable use, and greater operational stability. This intelligent prediction method ensures better resource management and helps maximize renewable energy efficiency while lowering reliance on traditional power forecasting

methods.

An Intelligent Framework for Proactive Mobile Application Adaptation Using LSTM-Based Network Prediction and Deep Reinforcement Learning

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Abstract:

Because of mobile apps and data-heavy services are growing so quickly, the need for good resource management in modern wireless networks has grown a lot. With technologies like 5G Network Slicing, network operators can divide one physical network into several virtual slices, each one optimized for a different set of services and performance needs. Most of the solutions available today focus on optimizing the network level and don't take into account how end-user applications behave and what they need. This is despite recent research that has come up with smart resource allocation strategies using Reinforcement Learning. Because of this, many current systems are still reactive and have trouble keeping application performance stable when network conditions change quickly. This work proposes a predictive and adaptive framework that integrates Deep Reinforcement Learning for intelligent decision-making with Long Short Term Memory-based network state prediction to address these limitations. By constantly watching important network parameters like bandwidth, latency, and packet loss, the suggested system can predict how the network will behave in the near future. The reinforcement learning agent changes how applications work in real time, including how they allocate resources and adapt to new situations, based on these predictions. This helps keep performance at its best and improves the overall Quality of Experience (QoE). The proposed framework's architecture is made up of several modules, such as network data acquisition, preprocessing and feature extraction, predictive modeling, decision optimization, and real-time application adaptation. The system changes from a purely reactive approach to a proactive resource management strategy by combining predictive analytics with adaptive decision policies. Experimental evaluation shows that the proposed model makes better use of resources while also lowering the risk of performance degradation when network conditions change. Also, the adaptive mechanism lets apps keep their service quality stable even when network resources are limited. In general, the proposed method offers a useful and scalable way to manage resources intelligently in next-generation wireless environments. The system helps make future mobile computing ecosystems more reliable, efficient, and user-friendly by connecting network-level resource allocation with application-level adaptation.

IoT-Based critical and non-critical load management in hospitals using ESP32 microcontroller

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Abstract:

This project presents an IoT-based smart power management system designed to enhance electrical reliability in hospitals by prioritizing critical and non-critical loads using an ESP32 microcontroller. Medical facilities require a stable power supply for life-saving equipment, but voltage fluctuations and brownouts often lead to device malfunctions. To address this, the proposed system implements a three-tier power hierarchy consisting of a diesel generator as the primary source, a battery bank for backup, and the grid supply as a last resort. An intelligent energy management logic

classifies loads into critical (ICU/ventilators), essential (ward lighting), and non-critical (admin/HVAC) categories. Using voltage and current sensors, the system continuously monitors the

AC grid and automatically triggers a multi-stage load shedding response when voltage drops below a safe threshold (e.g., 200V), diverting all available power to critical zones. The system includes an IoT interface for real-time monitoring via a mobile dashboard and is validated through MATLAB/Simulink simulations. This approach ensuresuninterrupted operation for life-critical devices, improves voltage stability, and provides a proactive solution for efficient hospital energy management.

A Real-Time Computer Vision System for College ID Card Detection and Information Extraction

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Abstract:

With the increasing use of digital technologies in educational institutions, there is a growing demand for automated systems that can efficiently manage student identification and data processing tasks. Many institutions still rely on manual verification of student identity cards for activities such as attendance monitoring, examination verification, and campus access control. These manual processes are often time-consuming, prone to human errors, and inefficient when handling large numbers of students. This creates a need for intelligent systems that can automatically detect and extract information from student ID cards.

The main problem addressed in this project is the lack of automated tools capable of detecting college ID cards and extracting relevant student information in real time. Existing approaches often require manual image uploads or human verification, which limits efficiency and increases administrative workload. Additionally, variations in lighting conditions, camera angles, and ID card formats make automated identification a challenging task. The objective of this project is to develop an real-time system that can detect college ID cards using a webcam and automatically extract essential student information. The system aims to reduce manual effort and improve the accuracy and speed of student identification by applying computer vision and deep learning techniques. The proposed system captures live video frames using a webcam and processes them through a computer vision pipeline. A deep learning–based object detection model (YOLOv8) is used to identify the ID card region within the video frame. Once detected, the ID card is isolated and processed using image preprocessing techniques such as grayscale conversion, noise reduction, and adaptive thresholding to improve text clarity. In the later stage, optical character recognition (OCR) can be applied to extract key information from the ID card, including the student's name, register number, department, and academic year. The expected outcome of this project is an intelligent system capable of automatically detecting and processing student ID cards in real time. This solution can significantly reduce manual data entry, minimize identification errors, and improve operational efficiency in educational institutions.

DESIGN AND DEVELOPMENT OF A HYDRAULIC STABILIZER FOR SUGARCANE INFIELDER

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Abstract:

Sugarcane infielder machines often face instability problems during loading due to uneven field conditions and heavy cane loads. This can lead to tilting, vibration and safety risks. To overcome this issue, a hydraulic stabilizer system was designed and developed for the sugarcane infielder. The system consists of a hydraulically operated support leg that extends to the ground during loading operations to provide additional support and improve balance. Load analysis and stability calculations were carried out to select a suitable hydraulic cylinder and structural frame. The fabricated stabilizer improves machine stability, reduces tipping risk, enhances operator safety and minimizes excessive stress on the chassis structure. The developed system is simple, cost-effective, easy to operate and can be integrated with existing sugarcane infielder machines to improve overall performance, durability and operational safety under field conditions.

AI Based Intelligent Employee Management System Using Supervised learning algorithms

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Abstract:

Effective employee management in contemporary organizations is difficult due to the numerous tasks involved, including internal services, performance evaluation, task distribution, attendance monitoring, and employee retention. Conventional employee management systems are primarily dependent on manual monitoring or simple software tools that are incapable of making intelligent decisions. HR departments find it more challenging to assess employee performance, forecast employee attrition, oversee day-to-day operations, and decide on promotions as companies expand. This project suggests an AI-Based Intelligent Employee Management System Using Supervised Learning that combines several employee-related modules into a single intelligent platform in order to address these issues. The suggested system allows for centralized employee management and data analysis by combining five separate modules into a single, cohesive mega module. The first module is the Employee Churn Risk Assessment System, which employs supervised learning models to evaluate employee data, including engagement levels, performance metrics, task completion history, and attendance patterns, in order to forecast the probability of an employee quitting the company. Organizations can increase employee satisfaction and retention by proactively identifying high-risk workers early on. The Employee Task Management System, the second module, enables managers to assign, monitor, and track tasks assigned to staff members. By examining task completion time, efficiency, and consistency, this module aids in assessing worker productivity. The Employee Attendance System, which digitally logs employee attendance and examines trends like tardiness, absences, and overtime, is the third module. Additionally, other AI modules like churn prediction and performance evaluation can use these attendance insights as input data. The Employee Food Poll System, which allows workers to cast votes for their preferred meals in the office cafeteria, is the fourth module. Based on employee preferences and participation levels, this module assists organizations in effectively planning food services. The Employee Promotion System is the fifth module. It employs supervised learning models to support data-driven promotion decisions by

utilizing historical performance data, task completion rates, attendance records, and productivity indicators. All five of the system's modules share a centralized database and analytics engine thanks to its modular architecture.

To find trends and produce wise forecasts and suggestions, machine learning models are trained on past employee data. The platform enhances workforce management, boosts employee satisfaction, facilitates HR decision-making, and minimizes manual administrative effort by combining these modules into a single, cohesive system. All things considered, the suggested AI-Based Intelligent Employee Management System shows how supervised learning and artificial intelligence can change conventional HR operations into a more intelligent, data-driven, automated employee management platform that enhances organizational effectiveness and strategic workforce planning.

DEVELOPMENT OF A SOLAR POWERED ROTARY DRYER WITH IOT ENABLED SYSTEM

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KONGUNADU COLLEGE OF ENGINEERING AND TECHNOLOGY.

Abstract:

Drying is an essential process in agriculture and food preservation to reduce moisture content and increase the shelf life of products. Traditional open sun drying methods are slow, weather dependent and prone to contamination from dust, insects and microorganisms. To overcome these issues a solar powered rotary dryer with an integrated environmental system is developed to provide efficient and hygienic drying. The system utilizes solar energy as the main heat source making it an eco-friendly and cost-effective solution. It consists of a rotating tray by a motor powered by solar panels. The rotary motion ensures uniform drying of materials by allowing equal exposure to heated air. The integrated environmental system helps regulate temperature, humidity and airflow inside the drying chamber. Sensors can be used to monitor these environmental conditions while ventilation mechanisms help maintain optimal drying conditions. This design improves drying efficiency, reduces drying time and maintains product quality. The system is suitable for drying grains, fruits, vegetables and spices especially in rural areas with limited electricity availability. This technology contributes to energy conservation, reduction of post-harvest losses and promotion of sustainable agricultural processing systems.

Multimodal Early Osteoporosis Risk Prediction Using Knee X-ray and Patient Data

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Ramco Institute of Technology Rajapalayam.

Abstract:

Osteoporosis is the kind of condition that doesn't announce itself — bones lose density quietly, and most people only find out something is wrong after a fracture has already happened. By that point, the damage is done. Early detection changes outcomes dramatically, but the standard diagnostic route, the DEXA scan, isn't always available. Rural clinics, under-resourced hospitals, and overstretched healthcare systems often simply don't have access to it. That gap is

what this work tries to address. The framework built here combines two things that are usually assessed separately — knee X-ray images and patient clinical information — to predict osteoporosis risk in a way that's both accessible and reliable. A CNN model handles the imaging side, examining X-rays and categorizing bone health into three stages: Normal, Osteopenia, and Osteoporosis. Alongside it, an XGBoost model works through the patient's personal profile — age, gender, diet, physical activity, hormonal history, smoking, alcohol use, and past fractures. The real strength comes from merging both models rather than picking one. Each captures something the other might miss, and combining their outputs through weighted probability fusion consistently produced better predictions than either could manage independently. Transparency was also a priority. Explainable AI techniques highlight which factors drove each prediction, giving clinicians something they can actually reason through rather than blindly accept. The whole system runs as a simple web application — a clinician uploads an X-ray, enters some patient details, and gets a risk assessment back almost immediately. No specialist equipment, no complicated setup. Just something that works where it's needed most.

SOCIAL MEDIA INFLUENCE ON PURCHASE DECISIONS OF COLLEGE STUDENTS

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Abstract:

Social media platforms have become a dominant source of information, communication, and digital marketing, significantly influencing consumer purchasing behavior, particularly among college students. Platforms such as Instagram, YouTube, Facebook, and WhatsApp expose users to advertisements, influencer promotions, peer recommendations, and product reviews that shape their purchase decisions. This study aims to analyze the extent to which social media platforms influence the purchasing behavior of college students and identify the key factors that drive these decisions. Primary data was collected through a structured survey using Google Forms, targeting college students from different academic backgrounds. A total of 100 responses were gathered, capturing information related to social media usage, advertisement interaction, influencer trust, engagement behavior, and product search patterns before purchase. The collected data was exported into Excel format and preprocessed using Python, where data cleaning, column standardization, and binary encoding techniques were applied using the Pandas library to prepare the dataset for analysis. The processed dataset was then analyzed using Power BI Desktop, where interactive dashboards were developed to visualize patterns and relationships within the data. Three analytical dashboards were created to explore different aspects of purchasing behavior, including the influence of social media platforms on purchase decisions, the impact of advertisements and influencer marketing on consumer trust, and the role of product search and verification behavior before making a purchase. The results of the study indicate that a significant proportion of college students are influenced by social media when making purchasing decisions, with Instagram and YouTube emerging as the most influential platforms due to their visual content and influencer-driven promotions. The analysis also reveals that fashion and electronics are among the most frequently purchased product categories, while influencer recommendations and advertisement engagement play a considerable role in shaping purchase intentions. Additionally, the findings show that many students perform additional product research through search engines and e-commerce platforms before making final purchase decisions, highlighting the importance of trust and information verification in digital consumer behavior. Overall, the study demonstrates that social media has become a powerful marketing channel that significantly affects consumer decision-making among young audiences. The

use of data analytics and interactive dashboards provides valuable insights for businesses, marketers, and researchers, enabling them to better understand consumer behavior patterns and design more.

SKYSKIN AERODETECT PATCH – AN EMBEDDED SOFTWARE FRAMEWORK FOR VIBRATION-BASED AIRCRAFT STRUCTURE MONITORING

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ABSTRACT:

Aircraft structures are continuously subjected to aerodynamic loads, engine vibrations, and environmental variations during operation. Continuous monitoring of structural behavior is therefore essential to ensure operational safety and structural reliability. A lightweight embedded monitoring framework, SkySkin AeroDetect Patch, is presented for vibration-based structural observation. Vibration measurements are obtained using the ADXL345 three-axis accelerometer, which provides acceleration data along the X, Y, and Z directions. Environmental parameters are measured using the HW-611 BMP280 barometric sensor, capable of providing atmospheric pressure, temperature, and altitude readings. Sensor data acquisition is performed using a microcontroller platform, and the collected measurements are transmitted to a computer through serial communication. Data analysis is performed using Python-based scientific libraries, where signal filtering and numerical processing are applied to improve signal quality. Feature extraction techniques are used to calculate vibration indicators such as peak amplitude and root mean square (RMS) values. Real-time graphical visualization enables continuous observation of vibration behavior and environmental variations. The monitoring framework demonstrates an efficient and cost-effective approach for vibration-based structural observation using embedded sensing and software-based signal analysis.

Keywords:
Aircraft Structural Health Monitoring, MEMS Sensors, Vibration Analysis, Embedded Systems, Python- Based Monitoring

Fshion Recommender System using CLIP DL Model

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Saranathan College Of Engineering

Abstract:

The growth of online fashion retail has increased the need for intelligent recommendation systems that can suggest visually similar products accurately and efficiently. Traditional recommendation methods mainly rely on textual descriptions, manual tagging, or user history, which often fail to capture important visual features such as color, pattern, texture, and style. They also face the cold-start problem when new products or users have limited historical data. This project proposes a fashion recommendation system based on deep learning embeddings and vector similarity search. A pretrained vision- language model is used to extract feature embeddings from product images, and

these embeddings are stored in a FAISS vector database for fast retrieval. The system supports both image-based and text-based queries, allowing users to search by uploading an image or entering a product description. Cosine similarity is used to retrieve the top similar products. To make the system practical for e-commerce use, product metadata is integrated through a CSV file containing product title, brand, image URL, and exact buying link. This enables the system to recommend similar products and provide the direct purchase link of the recommended item. A Streamlit-based interface is developed to make the system interactive, simple, and user-friendly To improve execution speed

without reducing accuracy, the system use local image caching, batch embedding generation, and persistent FAISS indexing. The proposed framework offers an efficient, accurate, and scalable solution for fashion e-commerce platforms, visual product search,and online shopping assistance.

FEDERATED LEARNING FOR PRIVACY PRESERVING HEALTHCARE DIAGNOSIS

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ABSTRACT

The rapid advancement of artificial intelligence and deep learning technologies has significantly transformed medical image analysis and automated disease diagnosis; however, the effectiveness of such models largely depends on access to large and diverse datasets that are often distributed across multiple healthcare institutions. Centralized data collection, while beneficial for model accuracy, raises serious concerns related to patient privacy, data security, regulatory compliance, and ethical constraints. In medical domains such a Tuberculosis detection from chest X ray images and Diabetic Retinopathy classification from retinal fundus images, data sharing between hospitals is particularly restricted due to the sensitive nature of patient informationIn the proposed system, each participating hospital trains a Convolutional Neural Network model locally using its private dataset and transmits only the learned model parameters to a centralized aggregation server through a secure communication channel. The server applies the Federated Averaging algorithm to combine local model updates into a refined global model, which is redistributed to all clients for iterative improvement. The tuberculosis detection component performs binary classification to identify positive and negative cases, whereas the diabetic retinopathy component performs multi class severity grading to assist in early diagnosis and treatment planning. The system is evaluated using standard performance metrics including accuracy, precision, recall, F1 score, and ROC AUC analysis, and experimental observations indicate that federated learning achieves diagnostic performance comparable to centralized training approaches while significantly enhancing privacy protection and scalability. The proposed framework demonstrates a secure, efficient, and practical solution for deploying collaborative artificial intelligence in healthcare environments, supporting early disease detection and contributing to improved patient outcomes while maintaining strict confidentiality standards.

Keywords: Federated Learning, Retinopathy Detection, Privacy Preservation, Healthcare Diagnosis, Medical Image Analysis.

MACHINE LEARNING APPROACH FOR PREDICTING SPECTACLE REQUIREMENT USING CLINICAL DATA

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ABSTRACT

This study proposes a machine learning approach to predict the requirement of spectacles using easily available clinical and demographic data. Uncorrected refractive errors are a leading cause of vision impairment worldwide[2]. Over 2.2 billion people are visually impaired globally, including about 6.8 million who are blind due to uncorrected refractive errors (UREs)[1]. Early detection of refractive errors is key to improving vision health[1], but traditional screening (autorefraction, retinoscopy, subjective refraction) requires equipment and specialized personnel[1][2]. In resource-limited settings, data-driven tools can augment screening. We developed a reproducible pipeline: data preprocessing, feature engineering, model training and evaluation. We trained and compared multiple supervised algorithms (Decision Tree, Random Forest, SVM, Logistic Regression, Naive Bayes, KNN) using metrics (accuracy, precision, recall, F1-score). The best model (Random Forest) was saved and integrated into a simple Flask web interface. Ensemble methods performed best. For example, Yang et al. achieved an AUC of 0.93 in myopia screening using a deep learning model on ocular images[2], and Syauqie et al. reported ~91% accuracy with a smartphone- image CNN[3]. In our experiments, Random Forest achieved the highest accuracy (≈92%). We present evaluation metrics, confusion matrix, and feature importance, and discuss limitations (dataset size, imbalance), ethical considerations (data privacy, misclassification risks), and future extensions (larger datasets, image features, mobile deployment).

Keywords: spectacle prediction, refractive error screening, machine

AI-Augmented Electricity Theft and Billing Anomaly Detection Using Hybrid Deep Learning Models

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Abstract

Electricity theft is a serious issue for power distribution companies, causing financial losses, grid instability, and inefficient energy management. Traditional detection methods, such as manual inspections and rule-based systems, are often slow and ineffective when dealing with large volumes of smart meter data. These methods also struggle to identify hidden and complex theft patterns, creating the need for intelligent automated solutions. This project proposes an AI-based electricity theft and billing anomaly detection system using hybrid deep learning models. The framework combines Convolutional Neural Networks (CNN) for feature extraction and Long Short-Term Memory (LSTM) and Bidirectional LSTM (BiLSTM) networks for analyzing time-series electricity consumption data. These models help capture both spatial patterns and temporal relationships in electricity usage behavior, improving the detection of suspicious activities. The system processes historical smart meter data through preprocessing steps such as data cleaning, normalization, and sequence generation. Advanced hybrid models, including CNN-LSTM and CNN-BiLSTM with attention mechanisms, are used to detect subtle anomalies in electricity usage. The output is then classified as either normal consumption or potential theft. To evaluate performance, the system uses standard metrics such as accuracy, precision, recall, F1-score, and ROC-AUC. The results help electricity providers identify suspicious consumers for further inspection. Overall, this approach offers a smart, scalable, and automated solution for electricity theft detection, reducing manual effort and improving monitoring

efficiency in smart grid environments.

Aqua sense Smart IoT water usage management and Quality Monitoring

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R P Sarathy Institute of Technology

Abstract

Water scarcity and deterioration of water quality have become major global concerns due to rapid urbanization and inefficient water management practices. This paper presents Aqua Sense, a smart IoT- based system designed for real-time monitoring of water usage and quality in residential water tanks, urban cities and commercial areas. The proposed system integrates flow of water, water level, pH, total dissolved solids (TDS), and turbidity sensors with an ESP32 microcontroller to continuously monitor water parameters. Sensor data is processed using threshold-based logic and an alert counter mechanism to reduce false alarms. Automatic motor control is implemented to prevent water overflow and dry-run conditions, while all operational data is logged to a cloud platform for remote access through a mobile or web dashboard. Experimental results demonstrate that the system effectively detects abnormal water conditions, reduces water wastage, and enhances user awareness. The proposed solution offers a cost-effective, scalable, and reliable approach for smart water management applications.

IMPROVED REACTIVE POWER CONTROL STRATEGY OF WIND TURBINES FOR TRANSIENT OVERVOLTAGE SUPRESSION IN LCC-HVDC SENDING GRIDS

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ABSTRACT

The stability of modern power systems is increasingly dependent on the seamless integration of renewable energy sources and high-capacity transmission links. Among these, the Line Commutated Converter-based High-Voltage Direct Current (LCC-HVDC) system remains a fundamental architecture for bulk power delivery due to its established economic benefits and technological maturity. However, a critical vulnerability of LCC- HVDC systems is the occurrence of commutation failures, typically triggered by disturbances in the AC grid. Such failures lead to a sudden and drastic reduction in the reactive power consumption of the rectifier, resulting in a substantial reactive power surplus at the AC sending-end bus. In weak AC grids, this surplus manifests as a severe Transient AC Overvoltage (TOV), which poses an immediate risk of off-grid tripping for connected wind farms. This paper presents a coordinated suppression framework that leverages both a Distributed Static Compensator (D-STATCOM) and an improved reactive power control strategy for wind turbines. While traditional D-STATCOM devices offer rapid reactive power absorption, their effectiveness is often constrained by their physical ratings and inherent control latencies. To address these limitations, the proposed strategy integrates a second-order Pade approximation to linearize and compensate for communication delays, alongside a predictive optimization algorithm based on voltage time- series data. This allows for a proactive rather than reactive suppression response. A comprehensive comparative analysis is conducted using a ±800 kV / 5000 MW LCC- HVDC simulation model developed in MATLAB/Simulink. Three distinct operational scenarios are evaluated: a baseline system with no overvoltage protection, a conventional system utilizing only D- STATCOM, and the proposed coordinated control involving both D-STATCOM and wind turbine participation. The simulation results indicate that the coordinated approach achieves superior performance, effectively reducing the peak TOV from 1.290 p.u. to 1.257 p.u. within the critical first cycle of the fault. These findings demonstrate that coordinating distributed renewable energy assets with central compensation devices can significantly enhance the transient voltage stability and operational security of the integrated power system.

TraceVision AI: A High-Throughput Person Identification System for Video Forensic Analysis

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Abstract:

Recent advances in deep learning and computer vision have significantly improved the performance of automated face recognition systems across various surveillance and security applications. At the same time, the rapid expansion of surveillance infrastructure in public and private environments has led to the generation of massive volumes of video data. Analyzing such large-scale surveillance footage manually is time-consuming, inefficient, and prone to human error, particularly in forensic investigations where investigators must review hours of video recordings to identify specific individuals. Although several automated face recognition systems have been proposed, many existing approaches are designed primarily for authentication scenarios and often require expensive

hardware resources or lack efficient mechanisms for analyzing long-duration surveillance videos. To address these limitations, this work proposes TraceVision AI, a high-throughput person identification system designed for efficient analysis of recorded surveillance footage. The proposed framework combines deep learning–based facial recognition with optimized video processing techniques to enable scalable forensic analysis on standard consumer hardware. The system constructs a biometric reference gallery by processing suspect images using Multi-Task Cascaded Convolutional Neural Networks (MTCNN) for accurate face detection and landmark-based alignment, followed by ArcFace for extracting highly discriminative facial embeddings. Each individual is represented as a 128-dimensional embedding vector, which serves as a compact biometric signature for efficient identity comparison. For surveillance analysis, the system extracts frames from recorded video streams at an optimized sampling rate and performs face detection using a Single Shot Detector (SSD) model to locate candidate faces within each frame. The detected faces are converted into embedding vectors using the ArcFace model and compared with the suspect gallery using cosine similarity to determine identity matches. To improve computational efficiency, the system incorporates an adaptive processing strategy that dynamically switches between sequential and multi-core parallel processing depending on video duration. Experimental evaluation demonstrates that the proposed system significantly reduces the time required to analyze long surveillance videos while maintaining reliable identification accuracy. The proposed framework provides a practical and scalable solution for transforming large-scale surveillance footage into actionable forensic intelligence for security monitoring and investigative applications.

Krishi Sakhi : AI-Powered Personalized Farming Assistant

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Abstract:

Krishi Sakhi - This project proposes the development of an AI-powered personal farming assistant designed to act as a digital companion for smallholder farmers by providing context-aware, timely, and personalized agricultural guidance. Many farmers rely on generalized advisories that often fail to consider their specific crop choices, soil conditions, weather patterns, farm size, and local farming practices, which can result in inefficient decision-making and reduced productivity. The proposed system addresses this gap by creating a smart, farmer-centric platform that learns and adapts to each farmer's unique context. The assistant will begin by building a comprehensive farmer and farm profile, capturing important details such as geographic location, land size, crop varieties, soil characteristics, irrigation methods, and cultivation practices. Using this information, the system will generate tailored recommendations for various stages of the crop cycle. A conversational interface will allow farmers to interact with the assistant using natural language through voice or text, enabling even those with limited digital literacy to easily access agricultural knowledge and support. The platform will also include activity tracking features, allowing farmers to record events such as sowing, fertilization, irrigation, pesticide application, pest sightings, and harvest activities in simple language. Over time, this information will create a digital farm diary, enabling data-driven insights and helping farmers reflect on past decisions and outcomes. Leveraging artificial intelligence, weather forecasting, and local agricultural knowledge bases, the assistant will provide proactive advisories and alerts, such as warnings about unfavorable weather conditions for spraying, pest outbreaks in nearby areas, or optimal timing for irrigation and nutrient application. In addition, the system will deliver reminders for critical farming operations, government scheme deadlines, and market price updates, helping farmers make informed economic decisions. A continuously evolving knowledge engine will integrate

crop calendars, pest and disease data, best farming practices, and localized insights to improve the accuracy and relevance of recommendations over time. By combining AI technology, real-time environmental data, and farmer-generated records, the solution aims to support farmers throughout the entire crop cycle—from planning and planting to harvest and post-harvest decisions.

BASED SMART CAR PARKING SYSTEM

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Abstract

The IoT-based smart car parking system is designed to provide an efficient and automated solution for managing parking spaces in crowded areas. Traditional parking systems often cause traffic congestion, time wastage, and fuel consumption due to the difficulty in finding available parking slots. This project uses sensors, microcontrollers, and cloud technology to detect whether parking spaces are free or occupied and provide real-time updates.The system collects parking slot information using sensors installed in each parking space and processes the data through a microcontroller. The information is then transmitted to the cloud through a communication module, allowing users to access the parking status through a web or mobile application. Users can check slot availability and reserve parking spaces in advance. By providing real-time monitoring and online slot booking, the proposed system improves parking management, reduces traffic congestion, saves time and fuel, and enhances user.

KEYwords : In the smart parking system project, the keyboard is used to input data, write code, and operate the software required for developing the web application and programming the microcontroller.

EXPERIMENTAL INVESTIGATION OF INCONEL 601 CASTING FOR HIGH TEMPERATURE APPLICATIONS

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ABSTRACT:

This study presents an experimental investigation into the casting and high-temperature performance of Inconel 601, a nickel–chromium-based superalloy known for its excellent oxidation resistance and mechanical stability in extreme environments. The research focuses on evaluating the influence of casting parameters and post-processing treatments on the microstructure and mechanical properties of Inconel 601. Samples were produced using precision investment casting and subjected to varying heat treatment conditions. Microstructural characterization was conducted using optical

microscopy, scanning electron microscopy (SEM), and X-ray diffraction (XRD). Mechanical properties, including tensile strength and hardness, were assessed at both room and elevated temperatures. The results indicate that optimized casting and heat treatment parameters lead to improved grain structure, reduced porosity, and enhanced high-temperature strength. These findings contribute to a deeper understanding of the processing– structure–property relationships in Inconel 601, supporting its application in high-temperature components such as gas turbines, furnace parts, and petrochemical equipment.

GROUND WATER ANALYSIS IN TELANGANA

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Abstract

With the increasing pressure on water resources due to population growth, agricultural demand, and climate variability, monitoring groundwater levels has become essential for sustainable water resource management. In regions such as Telangana, India, groundwater serves as a primary source of water for irrigation, domestic consumption, and industrial activities. However, irregular rainfall patterns and excessive groundwater extraction have led to declining water tables in several districts. Large volumes of groundwater and rainfall datasets are now available, creating opportunities to apply advanced data analysis and visualization techniques to extract meaningful insights. Traditional groundwater studies often rely on static reports and tabular data, which may not effectively reveal spatial and temporal patterns. This paper presents a data visualization–based analytical framework for groundwater assessment and trend analysis in Telangana using multi-year geospatial and environmental datasets. The proposed system integrates groundwater level data (2023–2025), groundwater fluctuation summaries (2022–2025), rainfallm records (2020–2022), and groundwater resource assessment data (2021–2022). The datasets are first preprocessed and analyzed using exploratory data analysis techniques to identify trends and anomalies. Interactive visualizations are then developed using Tableau to analyze district-wise groundwater levels, rainfall variations, seasonal fluctuations, and groundwater extraction patterns. The system also incorporates geospatial mapping and comparative visualization techniques to represent groundwater distribution across districts, enabling easier interpretation of spatial variations. Additionally, analytical dashboards highlight critical indicators such as groundwater recharge, extraction levels, and districts experiencing severe depletion. Experimental results demonstrate that the proposed system effectively identifies high-risk groundwater zones and reveals significant correlations between rainfall patterns and groundwater levels. The system provides a useful decision-support tool for researchers, policymakers, and water resource management authorities to improve planning, monitoring, and sustainable groundwater utilization. Keywords: Groundwater Analysis, Data Visualization, Tableau, Rainfall Analysis, Geospatial Data, Water Resource Management, Environmental Analytics.

Battery State of Charge Estimation Using Machine Learning Algorithms – A Comparative Performance Study

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ABSTRACT

State of Charge (SOC) represents the remaining energy available in a battery and is a critical parameter for the efficient operation of electric vehicles. Accurate SOC estimation improves battery performance, safety, and lifetime. However, traditional SOC estimation methods may become inaccurate due to temperature variations, load fluctuations, and battery aging. This study proposes a machine learning–based approach for accurate SOC estimation of lithium- ion batteries using real-time battery data. The experimental setup consists of an electric vehicle battery management system (BMS) with a 54 V, 52 Ah lithium-ion battery pack composed of 13 cells. The system includes a

battery, controller, single-phase Brushless DC (BLDC) motor, throttle, charge controller, and a spring balance setup used to apply varying load conditions. Battery parameters were monitored using Pixcel software, and data were collected from the BMS through a CAN protocol hardware interface. The recorded parameters include voltage, current, temperature, time, and SOC under different operating conditions, including with and without the BLDC motor load.The collected dataset was used to train three machine learning models: Random Forest, XGBoost, and Long Short-Term Memory (LSTM). The performance of these models was evaluated using Mean Absolute Error (MAE) and Root Mean Square Error (RMSE). Comparative analysis of the results shows that the LSTM model provides better prediction accuracy with lower RMSE and MAE values compared to Random Forest and XGBoost. The results demonstrate that machine learning-based approaches can significantly improve SOC estimation accuracy over conventional methods and support efficient battery monitoring and management in electric vehicle applications.

RAG-Based NLP Framework for Intelligent Legal Query Resolution in Indian Criminal Laws

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Abstract

The rapid transformation of criminal law in India, particularly with the introduction of new legal codes, has created a growing demand for systems that can provide clear and reliable legal information. Legal documents are generally written in complex and technical language, which makes it challenging for ordinary citizens and individuals without legal training to understand their rights, duties, and legal procedures. To address this issue, this project proposes a Retrieval-Augmented Generation (RAG) based Natural Language Processing framework designed to answer legal queries related to Indian criminal law. The proposed system combines document retrieval methods with advanced language models to produce context-aware responses based on authoritative legal sources. Important legal documents such as the Bharatiya Nyaya Sanhita, Bharatiya Nagarik Suraksha Sanhita,

and Bharatiya Sakshya Adhiniyam are processed and stored in a vector database to enable semantic search. When a user submits a legal question, the system retrieves the most relevant legal provisions and generates simplified explanations that are easier for users to understand. By grounding generated responses in verified legal documents, the system helps reduce incorrect or misleading outputs produced by language models. This improves the factual reliability and transparency of AI-assisted legal guidance. The proposed framework aims to build an efficient and scalable legal information platform that can later be extended to support multilingual interaction and voice-based query systems.

Keywords- Retrieval-Augmented Generation (RAG), Natural Language Processing (NLP), Legal Information System, Indian Criminal Law, Vector Database, Large Language Models (LLM), Semantic Search, Intelligent Legal.

Electric Vehicle Adoption and Environmental Impact Analysis

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Abstract:

The rapid growth of electric vehicles (EVs) has become a major factor in transforming the global transportation industry toward sustainable mobility. With increasing environmental concerns and the need to reduce carbon emissions, governments and industries are promoting electric vehicles as an alternative to traditional fuel-based vehicles. However, understanding the impact of EV adoptionrequires effective analysis of large datasets related to emissions, vehicle production, fuel types, and charging infrastructure. This paper presents a comprehensive analysis of electric vehicle adoption using data visualization techniques implemented in Tableau. Multiple datasets related to vehicle types, emissions, fuel consumption, charging station usage, and EV production were collected and analyzed to understand trends in EV growth and environmental impact. The data was cleaned and processed before being visualized through interactive dashboards. The proposed analysis framework enables the comparison of traditional fuel vehicles with electric vehicles in terms of pollution levels, energy consumption, and infrastructure availability. The results highlight the increasing adoption of EVs, the reduction of emissions compared to conventional vehicles, and the challenges associated with manufacturing resources and charging infrastructure. The visual dashboards provide insights that can support policymakers, researchers, and industries in making informed decisions regarding sustainable transportation systems.

Keywords: Electric Vehicles, Emission Analysis, Sustainable Transportation

AI in Healthcare

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Sri Chandra Shekharendra Saraswati vishwa Maha vidhyali

Abstract

Artificial Intelligence is completely turning the way healthcare works on its head - improving diagnosis, treatment, and care for patients all round. AI can incorporate machine learning, natural language processing and computer vision to swallow vast amounts of medical data and help doctors

make better choices.

AI Career Coach: An End-to-End Platform for Enhanced Career Readiness

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Abstract:

The current job market requires well-developed soft and technical skills, but traditional career coaching methods often don't have the ability to grow, be fair, or give feedback in real time. This paper talks about the AI Career Coach system, a groundbreaking artificial intelligence platform that helps people get ready for their careers from start to finish. The system gets around the problems with traditional methods by using three main AI-powered modules: an AI Resume Builder to improve application materials; an AI Assessment Generator to evaluate specific skills; and, most importantly, an AI End-to-End Voice Agent to hold real-time, simulated job interviews. The speech agent uses a complex pipeline that combines advanced Speech-to-Text (STT), Large Language Models (LLMs) for understanding context, and a unique Scoring Engine to give objective performance results in terms of language, technical skills, and behavior. Our method includes the modular architecture and the exact

algorithms used to rate performance in real time. The first results show that interview preparation is much more objective and efficient, giving candidates personalized, actionable feedback that they can't get from coaching by people. The AI Career Coach system is a scalable and very effective way to help people all over the world get ready for their careers.

Next Gen Learning Assistant for School Education using SKYRAG Model

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Abstract

The availability of digital educational resources such as textbooks and online learning materials has increased. However, students often struggle to interpret these materials independently, leading to reduced engagement. This has been seen to result in low student engagement and an inefficient learning process. The current educational systems that incorporate AI have been seen to mainly focus on question-answer scenarios. There is a lack of educational content-based learning guidance. This research aims to bridge this gap by proposing a gamified learning assistant that is based on an AI model that interprets educational documents to offer a structured learning process. The proposed model offers a structured learning process by utilizing NLP to interpret educational documents and offer a structured learning process based on the concepts in the documents. The proposed model offers a structured learning process by utilizing a RAG framework to allow a chatbot restricted to documents to answer student queries. In addition to that, a quiz system for evaluation is also proposed. The use of gamification and the sending of an automatic report to the parent mail for every week are also included. Based on the proposed application, it has been established that educational documents can be transformed to an interactive learning route to ensure their accessibility and the acquisition of knowledge. The proposed approach has proven the potential of the integration

of document understanding, artificial intelligence, and gaming strategies in the field of digital educational platforms to enable effective student learning.

Keywords: Artificial Intelligence, Gamified Learning, Retrieval-Augmented Generation, Educational Technology, Natural Language Processing

GLOBAL NATURAL DISASTER RISK PROFILING AND PATTERN MINING USING GEOSPATIAL HISTORICAL DATA

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Abstract

With the increasing occurrence of natural disasters worldwide, understanding disaster patterns and risk distribution has become essential for effective disaster management and preparedness. Large volumes of historical disaster data are now available, creating opportunities to apply data mining techniques for extracting meaningful insights. Traditional disaster analysis methods often focus on limited regional datasets and may not fully capture global patterns and relationships. This paper presents a data mining–based framework for global natural disaster risk profiling and pattern mining using geospatial historical data. The proposed system analyzes historical disaster records to identify patterns in disaster occurrence, frequency, and severity across different countries and regions. In the proposed approach, disaster datasets are first preprocessed and analyzed using exploratory data analysis techniques. K-Means clustering is then applied to group countries based on disaster frequency and types, enabling the identification of regions with similar disaster characteristics. The system also incorporates geospatial visualization techniques to represent disaster distribution on global maps, making the analysis easier to interpret. Additionally, a decision tree classification model is used to categorize countries into different risk levels based on disaster-related attributes such as total deaths, affected population, and disaster count. Experimental results demonstrate that the proposed system effectively identifies disaster-prone regions and reveals meaningful patterns in global disaster data. The system provides a useful analytical tool for researchers, policymakers, and disaster management agencies to support better planning, risk assessment, and disaster mitigation strategies.

Keywords: Data Mining, Natural Disaster Analysis, K-Means Clustering, Decision Tree, Geospatial Data, Disaster Risk Profiling, Pattern Mining.

Automated Identification of Rapid Urban Morphological Changes Using Deep Learning on Multi-Temporal Imagery

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ABSTRACT

Rapid urbanization has become one of the most significant global challenges, particularly in developing countries where population growth and economic development are accelerating the expansion of cities. As urban areas continue to grow, it becomes increasingly important to monitor urban development patterns and predict future expansion to support sustainable planning and infrastructure development. Traditional approaches for analyzing urban growth often rely on manual interpretation of satellite imagery or classical machine learning techniques, which may struggle to

capture complex spatial patterns and long-term temporal relationships present in large-scale geospatial datasets. Therefore, automated methods that utilize advanced deep learning techniques are required to accurately detect and analyze urban morphological changes over time. This research presents an intelligent framework for the automated identification and prediction of urban growth using multi-temporal satellite imagery. The proposed system utilizes publicly available satellite datasets such as Sentinel-2 and Landsat images to analyze urban expansion across multiple years. Initially, the collected satellite images undergo several preprocessing steps, including cloud removal, radiometric normalization, spatial alignment, and resolution standardization to ensure consistency across different time periods. These preprocessing techniques improve the quality and comparability of satellite images, enabling reliable analysis of urban changes. After preprocessing, a deep learning-based semantic segmentation model using the U-Net architecture is applied to classify each pixel in the satellite images as urban or non-urban. The segmentation process generates binary urban masks that represent built-up areas for different years. These masks are then compared using post-classification change detection methods to identify newly urbanized regions and analyze historical urban expansion patterns. To predict future urban development, a hybrid CNN-LSTM model is employed to capture both spatial and temporal characteristics of urban growth. The CNN component extracts spatial features from segmented urban maps, while the LSTM network learns long-term temporal relationships across multiple years of urban development data. This approach enables the system to generate probabilistic maps highlighting potential future urban expansion areas. Furthermore, the framework integrates Explainable Artificial Intelligence (XAI) using the Grad-CAM technique to provide visual explanations of the model's predictions. The generated heatmaps highlight important regions in satellite images that influence the model's decisions, thereby improving transparency and trust in the results. Overall, the proposed framework provides an automated and interpretable approach for analyzing historical urban growth and predicting future urban expansion, supporting urban planners and policymakers in making informed decisions for sustainable city development.

Diabetic Retinopathy Classification UsingDeep Learning Algorithm

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Abstract

Diabetic Retinopathy (DR) is an eye disease associated with diabetes that has the potential to severely impair vision or lead to blindness through its development over time. When DR is detected early and effectively treated, patients are less likely to experience the severe loss of vision from DR that can often occur if there is significant delay in diagnosis or treatment. The development of a diabetic retinopathy classification system (DRCS) using deep learning techniques for automatically identifying and classifying retinal images into the various stages of diabetes, supporting timely diagnosis. This is accomplished with the use of Convolution Neural Networks (CNN) to analyze images of fundus and classify as abnormal. Once the deep learning model has been trained, it is utilized to process retinal images to estimate the severity of DR. The DRCS improves the accuracy of DR classifications and provides relief to medical professionals by allowing them to accomplish other activities while providing early treatment for DR. Results of the experiments demonstrate

classifications of images into DR stages with high accuracy.

AI-POWERED STUDENT MOCK INTERVIEW AND EVALUATION SYSTEM FOR EDUCATIONAL INSTITUTIONS

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Abstract

The preparation of students for interviews is an important factor in improving their chances of finding work, but the traditional method of doing this through mock interviews has limitations caused by time, the number of students who can be accommodated, and subjective evaluation. This research introduces an AI-Powered Mock Interview and Evaluation System which simulates a real interview environment using technologies such as Natural Language Processing (NLP), Machine Learning (ML) to assess students' responses, and illustrates performance with structured feedback at the time of providing those responses. The system consists of an automated question generation engine, a speech-to-text conversion engine, a confidence evaluation engine, and visual representation of students' performance, all of which operate in a web browser. The linguistic quality of the student's responses, the validity of the student's responses to the questions posed by the model, and the student's confidence can be evaluated using machine learning models. This system provides a means of

obtaining an objective and consistent evaluation of students, and reduced burden on faculty. Our experimentation of the system revealed that the accuracy of speech recognition was acceptable, and allowed for effective classification of interview performance for multiple interviews across all student subjects. This system improves student confidence, readiness for interview, and increases efficiency of training in educational institutions. This methodology offers a scalable, cost-efficient means of improving employability outcomes for students in educational institutions.

Brand Reputation Analytics System for Nike

Jallela Praveen 1 Dr.V. Aruna 2

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2 Assistant professor, Dept. of MCA, School of Informatics, Aurora Higher Education and Research Academy Deemed-to-be-University., Uppal, Hyderabad, Telangana, India

Abstract

With the rapid growth of social media and digital platforms, customer opinions and online interactions play a significant role in shaping brand reputation. Organizations must continuously monitor customer feedback to understand public perception, identify potential issues, and maintain a competitive advantage. However, traditional methods of reputation monitoring often rely on manual surveys and basic analytics tools, which may fail to capture deeper insights from large volumes of textual

feedback data. This paper presents a data analytics–based framework for brand reputation monitoring and sentiment analysis using customer feedback data. The proposed system analyzes survey-based feedback collected from customers to understand sentiment patterns and brand perception related to Nike products. In the proposed approach, the collected dataset is first preprocessed using Python to clean textual responses, removenoise, and standardize attributes. Exploratory data analysis techniques are applied to examine data distribution and customer behavior patterns. Sentiment analysis using Natural Language Processing techniques is then implemented to classify customer opinions into positive, neutral, and negative sentiments. The system also incorporates a keyword alert mechanism to identify frequently occurring negative terms related to product quality, pricing, comfort, and service issues. In addition, a competitor comparison analysis is performed to evaluate Nike's reputation relative to other sportswear brands based on customer responses. The analytical results are visualized using interactive Power BI dashboards, enabling clear interpretation through charts, key performance indicators, and filters. Experimental analysis demonstrates that the proposed system effectively identifies customer sentiment trends, major complaints, and competitive positioning. The system provides a useful analytical tool for brand managers, marketing teams, and researchers to support better decision-making, reputation management, and customer experience improvement strategies.

Taskora - A Cloud-Native Enterprise Collaboration System withGenerative AI for Intelligent Work Execution

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Kamaraj College of Engineering and Technology

Abstract

Modern organizations increasingly rely on digital collaboration platforms to coordinate tasks, manage workflows, and support distributed teams. However, many existing enterprise collaboration tools primarily focus on task tracking and communication, offering limited intelligent support for work execution and decision-making. This limitation often leads to inefficient task planning, lack of visibility into dependencies, and increased manual effort in managing project workflows. To address these challenges, this paper presents Taskora, a cloud- native enterprise collaboration system enhanced with Generative Artificial Intelligence (AI) to facilitate intelligent work execution and team coordination. Taskora is designed to integrate advanced cloud computing capabilities with AI-driven insights to provide a scalable and efficient platform for enterprise collaboration. The system architecture follows a modular design consisting of a React-based frontend interface, a backend application server with API gateway integration, a Generative AI processing layer, and a cloud deployment environment. The frontend module provides a user-friendly interface for task creation, monitoring, and workflow visualization, allowing users to interact with the system through dashboards and natural language inputs. The backend platform manages core system logic, including task lifecycle management, workflow coordination, an role-based access control (RBAC), ensuring secure access and controlled interaction among users. A key feature of the proposed system is the

integration of Generative AI for intelligent task processing. Through natural language processing techniques, the system interprets user-provided task descriptions and converts them into structured and actionable workflows. The AI module assists in task decomposition, priority suggestion, dependency identification, and automation recommendations, thereby reducing the manual workload associated with planning and coordination. This capability allows organizations to transition from traditional manual task management toward an intelligent and automated execution environment. In addition to AI-driven functionality, Taskora incorporates real-time collaboration features using event-driven communication mechanisms such as WebSockets. These capabilities enable instant synchronization of task updates, notifications, and collaborative interactions among team members. Real-time visibility into task progress and system activities helps improve coordination, reduce delays, and ensure that team members remain informed about ongoing developments within projects.

UNIFIED DEEP LEARNING APPROACH TO DYSLEXIA DETECTION VIA SCRIPTUAL, AUDITORY, AND OCULOMOTOR CUES

ASHWINI | **BINDHUSREE** | **DURGADEVI**

S.A.Engineering College

Abstract

Dyslexia is a disease marked by poor speech and sound perception, as well as reading difficulties. They struggle with reading comprehension and are less able to connect letters and make words. Dyslexia is a problem with phonological processing and word decoding rather than a visual impairment disease. Their handwriting and eye movement patterns when reading both show these challenges. Children with normal vision and IQ can have dyslexia. The goal of this research is to provide techniques for automating the early detection process, relieving teachers of their workload and eliminating racial or socioeconomic bias in detection. To create a screening tool that uses several ML algorithms to recognize speech, handwriting, and eye movements in order to identify dyslexia in children early on. Optical Character Recognition (OCR) will be used to translate the handwriting images into machine-encoded form. ANN and SVM will then be used to determine whether or not a child is dyslexic. The eye movement will be the basis of the second test, which will employ algorithms like CNN. The third approach uses an NLP algorithm for speech recognition in order to comprehend phonological challenges. The test's combined results will enable us to differentiate between dyslexic children and those who are not. The results of this study offer a practical and efficient method for identifying dyslexia characteristics in young children. Due to the difficulties of identifying dyslexia in children and teenagers, the diagnosis of dyslexia features is frequently postponed because it is an expensive and time- consuming process.

An Intelligent Web-Based Stock Market Dashboard with AI Conversational Assistance

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Chennai.

Abstract:

Retail investors frequently encounter significant challenges when navigating complex stock market analyses, often struggling to interpret financial metrics and market trends due to the overwhelming presentation of raw data on traditional platforms. While existing trading applications and financial websites offer extensive data, they largely lack integrated, context-aware educational support and guided intelligent explanations. To address this gap, we introduce Stock IQ Tracker (STOX), a web-based intelligent stock market dashboard specifically designed to simplify financial understanding and improve investment decisions for beginners. STOX proposes a unified architecture that integrates a real-time stock analysis tool with an AI-powered conversational assistant sidebar. Developed utilizing a Python- based Flask backend and a responsive HTML/CSS/JavaScript frontend, the system employs a custom stock intelligence engine relying on keyword-based logic to process user queries against a stock database. By translating complex stock data—including risk insights, sector information, and performance summaries—into simple, accessible language, STOX functions simultaneously as an analysis tool and a learning assistant. The resulting platform offers a modular, interactive experience with a premium user interface, successfully bridging the gap between complex market data and retail investors to ultimately enhance decision-making confidence.

Adaptive Window Factor Graph Optimization for PDR-GNSS in Real-Time Pedestrian Navigation

Dr. K. Vijayalakshmi | **Ms. V. Kavya**

Abstract:

Accurate pedestrian navigation across both indoor and outdoor environments remains a challenging problem in modern mobile navigation systems. Global Navigation Satellite System (GNSS) technology provides reliable positioning in open outdoor environments, but its accuracy significantly decreases in dense urban areas and indoor spaces due to signal blockage and multipath interference. On the other hand, Pedestrian Dead Reckoning (PDR) uses data from inertial sensors such as accelerometers and gyroscopes to estimate a person's movement when GNSS signals are weak or unavailable. Although PDR helps maintain continuous tracking, its estimates gradually drift over time because small sensor errors accumulate during movement. Combining GNSS and PDR through sensor fusion can therefore provide more reliable positioning. This work proposes an adaptive navigation approach that integrates GNSS and PDR using Factor Graph Optimization (FGO). Unlike traditional Kalman filter–based methods that process measurements sequentially, factor graphs allow the system to optimize multiple states simultaneously and revise previous estimates when new information becomes available. However, many existing FGO implementations rely on a fixed optimization window size, which limits their ability to adapt to varying environmental conditions. A small window improves computational speed but reduces accuracy during GNSS outages, while a large window increases accuracy but adds unnecessary computational overhead. To address this limitation, the proposed system introduces an adaptive sliding- window mechanism that dynamically adjusts the optimization window based on GNSS signal quality and pedestrian motion patterns. GNSS quality is estimated using parameters such as satellite count and horizontal dilution of precision, while motion variance is derived from step-length changes detected by smartphone sensors. Depending on these conditions, the algorithm selects an appropriate optimization window size to balance accuracy and processing efficiency. The navigation system is implemented as an Android application that collects sensor data in real time and performs optimization using factor graph techniques. For deeper analysis and validation, batch processing is also supported through cloud-based computation. Experimental

evaluation was conducted on a mixed indoor–outdoor campus route covering open spaces, corridors, staircases, and partially obstructed areas. The results demonstrate that the adaptive FGO approach improves positioning accuracy compared with conventional GNSS-only navigation, Kalman filter fusion, and fixed- window factor graph methods. The proposed method achieves lower positioning error while maintaining real-time performance suitable for smartphone applications. Overall, the study shows that adaptive optimization strategies can significantly enhance pedestrian navigation systems by dynamically responding to environmental conditions and sensor reliability.

MALICIOUS AND PHISHING URL DETECTION USING MACHINE LEARNING

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B.UMAMAHESHWARI, M.VENKATA LAKSHMI
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ABSTRACT:
Malicious and phishing websites have become a serious threat to internet users in recent years. Traditional Security mainly relied on blacklist-based method, which block URLs already identified as harmful, but they often fail to detect newly created phishing sites. To overcome this limitation, researchers introduced heuristic and machine learning techniques that analyze patterns and structural features of URLs. In this study, various URL features are extracted and used to train machine learning models to identify whether a website is safe or malicious .Algorithms such as decision tree , random forest ,and support vector machine are commonly used for this purpose. In addition vectorization techniques like TF-IDF help convert URL text into numerical data for better analysis. The proposed approach aims to improve detection accuracy while providing faster and more reliable protection against malicious URLs. This method uses fake websites or harmful links that look like real ones to trick people into sharing private information, such as login details, bank information, or personal data. As online services such as e-commerce, digital banking, and social media platforms have expanded quickly, phishing attacks have risen sharply in recent years. Hence, advanced detection methods are needed to recognize harmful URLs before users visit these dangerous sites. Recent interest in using machine learning and deep learning methods for phishing detection has grown significantly, thanks to their capability to process large datasets and uncover concealed patterns in URLs and websites.

Smart irrigation System to predict optimal wateringSchedules

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Abstract:
Efficient irrigation management is a critical challenge in modern agriculture due to increasing water scarcity, climate variability, and inefficient traditional irrigation practices. Conventional irrigation systems operate on fixed schedules or manual supervision, leading to over-irrigation or under-irrigation, which directly affects crop yield and water conservation. To address these limitations, this

paper proposes a Smart Irrigation System integrating Machine Learning and Microservices Architecture to optimize irrigation decisions dynamically based environmental conditions. The system utilizes environmental parameters including temperature, humidity, soil moisture, rainfall, soil type, crop type, and growth stage to predict irrigation requirements. A realistic synthetic dataset was generated to simulate agricultural field conditions, and multiple regression models were trained to estimate irrigation water demand in millimeters. The system is implemented using a distributed microservices architecture consisting of an Environment Simulation Service, Machine Learning Prediction Service, Decision Control Service, Redis-based State Management, and a React Dashboard Interface. Performance evaluation was conducted based on prediction accuracy, response time, irrigation efficiency, and water conservation percentage. Experimental results demonstrate that the proposed system significantly reduces water wastage while maintaining optimal soil moisture levels. The modular microservices deployment ensures scalability, flexibility, and real-time monitoring capabilities. The proposed framework can be extended to large-scale agricultural applications and IoT-integrated smart.

CricAI: An AI-Powered Cricket Intelligence Platform for Player Performance Improvement and Strategy Generation

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Abstract:

This paper presents CricAI, an intelligent cricket analytics and training simulation system designed to extract tactical insights from large-scale historical cricket data. Modern cricket generates extensive ball-by-ball datasets, yet transforming this raw information into actionable insights for performance improvement and strategy development remains a significant challenge. The proposed system addresses this problem by integrating data processing, statistical analysis, and artificial intelligence techniques to analyze player performance and match dynamics. The system processes ball-by-ball match data, scorecards, and player statistics using a structured data pipeline implemented in Python. Key performance indicators such as strike rate, scoring patterns, dismissal types, and phase-wise contributions are extracted to identify player strengths and weaknesses. Advanced analytical metrics including pressure index modeling and normalized impact scoring are used to quantify player performance and match influence under varying game conditions. To enhance analytical capabilities, the system incorporates a Grounded Retrieval- Augmented Generation (RAG) framework that retrieves relevant match context from vectorized cricket data using semantic embeddings. This approach enables the AI engine to generate context-aware insights, tactical explanations, and player comparisons based on real historical match evidence. Based on the analysis, the platform generates personalized training recommendations, strategic match insights, and performance evaluations for players and teams. A web- based interface allows users to interactively explore data-driven cricket intelligence through modules such as player analysis, match flow evaluation, and tactical advisory tools. The proposed system demonstrates how sports analytics,

machine learning, and AI-driven reasoning can transform large-scale cricket datasets into practical decision-support tools for coaching, performance analysis, and strategic planning.

PRIVACY-ENHANCED BLOOD DONATION EMERGENCY SUPPORT APPLICATION USING GPS BASED LOCATION IDENTIFIER.

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Meenakshi Sundarrajan Engineering college

ABSTRACT:

Timely access to compatible blood is a critical factor in saving lives during medical emergencies. Traditional blood donation systems often rely on manual communication, centralized databases, or public appeals, which may delay the process of identifying and contacting suitable donors. To address these challenges, this paper proposes a Blood Donation Management System using GPS-based location tracking and real-time notification services. The proposed system aims to create a dynamic platform that efficiently connects blood donors, recipients, and healthcare organizations through a location-aware mobile and web application. The system integrates Global Positioning System (GPS) technology to identify and locate registered blood donors within a specific geographic radius of a blood request. When a hospital or patient raises a request for a particular blood group, the system automatically searches the database for nearby eligible donors based on their current or registered location. Real-time notifications are then delivered to these donors, informing them about the urgent blood requirement and allowing them to respond quickly. This approach significantly reduces the time required to locate compatible donors and improves the overall responsiveness of the blood donation network. The proposed platform also includes several functional modules such as donor registration, blood group classification, eligibility verification, request management, and notification services. These features ensure proper organization of donor information and enable efficient communication between users and healthcare institutions. By promoting voluntary participation and quick response mechanisms, the system helps establish a reliable and accessible donor network capable of supporting emergency medical situations. From a technical perspective, the system follows a layered architecture consisting of a client interface, application server, and cloud-based database layer. The backend services are implemented using node js, which handles request processing, API communication, and notification management. Donor and request data are securely stored and managed using deployed on an online cloud database platform, enabling scalable and real-time data access. This architecture ensures efficient data handling, faster query execution, and reliable system performance. Overall, the implementation of this GPS-enabled blood donation management system enhances the efficiency, reliability, and accessibility of blood donation services. The proposed solution has the potential to reduce critical delays in emergency situations and support healthcare institutions in managing blood resources more effectively, ultimately contributing to improved patient outcomes and community health support systems.

SMARTCRICKXI: DATA-DRIVEN CRICKET PLAYER SELECTION USING RULE-BASED INTELLIGENCE

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Abstract
Cricket analytics has become increasingly important in modern T20 cricket, where selecting an optimal playing XI significantly influences match outcomes. Traditional player selection methods primarily rely on expert judgment and manual analysis of past performances, which may introduce subjectivity and limit the effective use of large-scale cricket datasets. This research proposes SmartCrickXI, a data-driven cricket player selection framework that integrates web scraping, Python-based analytics, and a rule-based decision system. Historical player performance data was collected by performing web scraping on ESPNcricinfo using Python libraries such as Requests and BeautifulSoup. The extracted data was processed using Pandas and NumPy to compute key performance metrics including batting average, strike rate, boundary percentage, wickets taken, bowling economy rate, and bowling strike rate. Players are categorized into roles such as batsmen, bowlers, all-rounders, and wicketkeepers using predefined statistical thresholds. The system is implemented as a Flask-based web application that allows users to manually specify the number of players required in each category and select pitch conditions such as batting-friendly or bowling-friendly surfaces. Based on these inputs, the rule-based algorithm ranks players and generates an optimal playing XI. After the team is generated, the system displays the selected eleven players along with their corresponding performance statistics, including batting average, strike rate, wickets taken, and bowling economy rate, through the web interface. This enables users to clearly analyse the statistical strengths of each selected player. The SmartCrickXI framework demonstrates how sports analytics and web-based applications can support objective and data-driven decision-making in cricket team selection.

Predicting Profitable Items in Indian vegetable markets

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2 Assistant professor Mr.A.Rajeshwar, Dept. of MCA, School of Informatics, Aurora Higher Educationand Research Academy, Uppal, Hyderabad, Telangana, India

Abstract
Indian vegetable markets are highly dynamic environments where prices, demand, and purchasing patterns frequently change across cities and seasons. Vendors often rely on experience rather than data-driven insights to decide which vegetables to stock and how to bundle them for maximum profit. This research proposes a machine learning–based system to predict profitable vegetable sales and identify high-value item combinations in Indian vegetable markets. The proposed system integrates a Logistic Regression classification model with Market Basket Analysis using the Apriori algorithm to analyze transaction data and discover patterns associated with profitable sales. The model is trained on features such as vegetable type, quantity sold, price per kilogram, city, season, and weekday to predict whether a transaction will generate profit. Additionally, association rule mining is used to identify frequently co-purchased vegetable combinations that contribute to higher profitability. The

system is deployed through a Flask-based web application, allowing users to input transaction details and receive real-time predictions along with useful market basket insights. Experimental results demonstrate that the model achieves strong classification performance and effectively identifies profitable item combinations. The proposed system provides a practical decision-support tool for vegetable vendors and retailers, enabling smarter inventory planning, pricing strategies, and sales optimization in dynamic retail environments.

Blockchain-Based Secure Food Safety and Traceability System

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Abstract

Food safety and traceability have become critical concerns in modern food supply chains, particularly in the dairy industry where improper storage, contamination, or lack of monitoring can lead to serious health risks for consumers. Traditional supply chain systems rely on centralized databases and manual record keeping, which often lack transparency and are vulnerable to data manipulation. To address these challenges, this paper proposes a Blockchain-Based Secure Food Safety and Traceability System designed to improve transparency, security, and reliability in milk distribution networks.The proposed system integrates blockchain technology, QR code tracking, and a mobile application to monitor milk products throughout the supply chain. Each milk batch is assigned a unique QR code containing essential information such as farm origin, collection date, storage conditions, and transportation details. These records are securely stored on a blockchain ledger, ensuring immutability and preventing unauthorized data modification. Consumers can scan the QR code using a mobile application to access the complete traceability history and safety status of the milk product.The implementation demonstrates how blockchain technology can provide a secure and tamper-resistant framework for food traceability while enabling consumers to verify product authenticity in real time. By improving transparency and accountability across the dairy supply chain, the proposed system enhances consumer trust and helps identify unsafe or spoiled milk products quickly.

Analysis the Steels Members With Shear Hole and Simple Shear Connection

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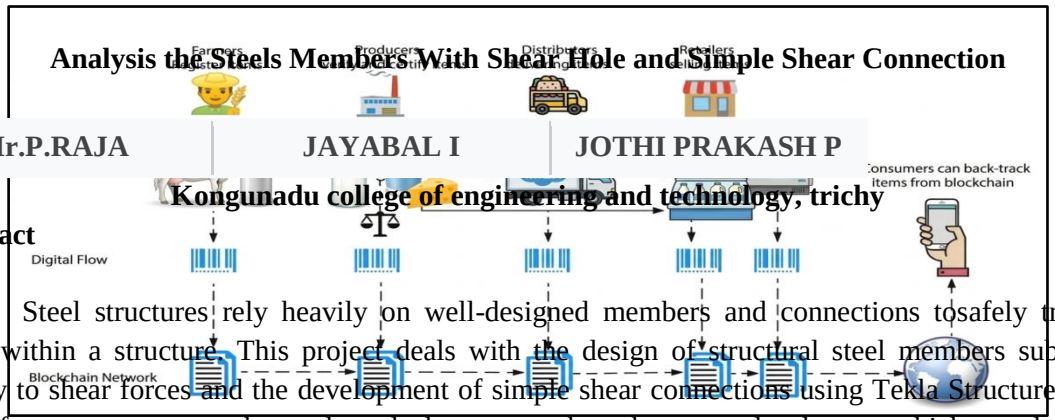
Kongunadu college of engineering and technology, trichy



Abstract

Steel structures rely heavily on well-designed members and connections tosafely transfer loads within a structure. This project deals with the design of structural steel members subjected mainly to shear forces and the development of simple shear connections using Tekla Structures. The work focuses on commonly used steel elements such as beams and columns, which are designed under assumed loading conditions by following standard steel design guidelines. Simple shear

connections including fin plate, end plate, and angle cleat connections are selected for this study because of their simplicity, economy, and ease of construction. Tekla Structures is used throughout the project to model the structural frame in three dimensions and to accurately detail the connections. The software allows proper definition of material properties, connection components, bolt arrangements, and weld details, ensuring that the designed connections are safe and practical for fabrication. Design checks are performed to verify the adequacy of bolts, plates, and welds against shear, bearing, and block shear failures. The use of Tekla Structures helps in visualizing the behavior of connections, reducing design errors, and improving coordination between design and fabrication. General arrangement drawings, shop drawings, and material quantities are automatically generated from the model, saving time and minimizing manual work. Overall, this project demonstrates how BIM-based tools like Tekla Structures can be effectively used for the design and detailing of simple shear connections, leading to accurate, efficient, and construction-ready structural steel designs.

SMART WEARABLE DEVICE FOR EARLY DETECTION AND THERAPY OF RAYNAUD'S PHENOMENON

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Vel Tech Multi Tech Dr.Rangarajan Dr.Sakunthala Engineering College(Autonomous)

ABTRACT

This project presents a smart wearable device designed for the early detection and management of Raynaud's Phenomenon. The device continuously monitors finger temperature and blood flow using sensors, and detects abnormal patterns that signal the onset of Raynaud's attacks. When detected, it activates a mild heating system and activate motor to make blood flow to restore blood circulation and prevent symptoms. The wearable is lightweight, user-friendly, and offers a non-invasive way to improve comfort and reduce complications for individuals with Raynaud's.

RETENTION PRO - DATA QUALITY AWARE CUSTOMER RETENTION PREDICTION

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ABSTRACT

Customer retention has become an important focus for many businesses, as keeping existing customers is usually more cost-effective than attracting new ones. However, predicting whether a customer will stay or leave a service can be difficult when the available data contains quality issues. Problems such as missing values, duplicate records, inconsistent data formats, and noisy information can reduce the accuracy of machine learning models. Therefore, improving data quality before building predictive models is an essential step. This project presents a Data Quality-Aware Customer Retention Prediction System that combines data quality analysis with machine learning techniques. The system first analyzes the dataset to identify common data quality problems such as missing values, duplicates, outliers, and inconsistencies. After detecting these issues, different preprocessing techniques such as data cleaning, normalization, and feature engineering are applied to improve the quality of the dataset.Once the data quality is enhanced, machine learning models are trained to predict customer retention more effectively. The project also compares model performance before and after data quality improvement to highlight the impact of clean and reliable data on prediction accuracy. Different algorithms such as Logistic Regression, Random Forest, and Gradient Boosting are used to determine which model performs best for customer retention prediction. In addition, the system includes a user-friendly interface where users can upload datasets, view data quality reports, explore visual insights, and obtain customer retention predictions. By combining data quality assessment with predictive modeling, the proposed system helps organizations make better data-driven decisions and improve their customer retention strategies.

Smart Battery Thermal Management with Swelling Detection System

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Abstract

Lithium-ion batteries are widely used in electric vehicles, renewable energy storage, and portable electronics, but are prone to thermal runaway caused by excessive heat generation and internal gas formation during charge-discharge cycles. Conventional Battery Thermal Management Systems (BTMS) rely solely on temperature sensing and fail to detect early internal fault indicators such as cell swelling and pressure rise. This paper presents a smart BTMS integrated with a Swelling Detection module using an LM35/NTC thermistor for temperature monitoring and an FSR pressure sensor for physical expansion detection,both processed by an ESP32 microcontroller. A multi-component MATLAB swelling model , thermal and lithium-plating contributions — is developed and validated, confirming a detection threshold of 70 µm. The system activates cooling (fan), alarm

(buzzer/LED), and LCD display outputs based on configurable thresholds. Simulation results confirm total swelling rises from a 65 µm baseline to 140 µm peak during charging,with close model-to-experimental agreement, validating the proposed early-fault detection approach.

An LLM-Based Multimodal Chatbot for Preliminary Diagnosis

Prabha M | **Monisha D** | **Sivasankari PK**

Saranathan college of engineering

Abstract

In today's fast-paced world, maintaining proper healthcare is often neglected due to busy lifestyles, limited awareness, and restricted access to medical professionals. To address this challenge, the integration of Artificial Intelligence (AI) in healthcare has enabled the development of intelligent systems that provide quick and reliable medical assistance. This project presents a Personalized Healthcare Chatbot that identifies potential illnesses based on user- provided symptoms and provides preliminary medical guidance before consulting a doctor. By utilizing Machine Learning (ML) and Natural Language Processing (NLP), the chatbot understands user queries in natural language, analyzes symptoms, and delivers accurate and context-aware responses. The system acts as a virtual health assistant, allowing users to describe their health concerns and receive instant health-related guidance. The chatbot is trained on medical datasets to predict possible diseases based on the symptoms entered by users and provide appropriate suggestions. It can offer guidance for minor health issues and recommend medical consultation for serious conditions by suggesting suitable doctors or specialists. By reducing unnecessary hospital visits, lowering healthcare costs, and improving accessibility for individuals in remote areas, the proposed AI-driven system promotes early diagnosis, health awareness, and proactive healthcare management. This approach contributes to making personalized healthcare support more efficient, convenient, and accessible.

FPGA-Based Real-Time Indian Sign Language Recognition Using a Lightweight CNN Architecture

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Abstract:

Indian Sign Language (ISL) recognition systems play an important role in enabling communication between hearing-impaired individuals and the general public. However, traditional software-based gesture recognition methods often suffer from higher latency and limited real-time performance when implemented on general-purpose processors. This work proposes an FPGA-based real-time ISL recognition system using a lightweight Convolutional Neural Network (CNN) architecture. The lightweight CNN model is designed to reduce computational complexity while maintaining high recognition accuracy, making it suitable for hardware implementation. The trained CNN model is deployed on an FPGA platform to exploit hardware parallelism and pipelined processing for faster inference. Compared to conventional software implementations, the FPGA-based

system achieves improved performance in terms of latency, throughput, and power efficiency. The hardware acceleration enables faster gesture classification and supports real-time sign language interpretation. Experimental evaluation demonstrates that the proposed architecture provides a balanced trade-off between computational efficiency and recognition performance. The results highlight the potential of FPGA-based deep learning systems for developing efficient assistive communication technologies for the hearing- impaired community.

POWER FLOW GUARDIAN: ANDROID ALERT SYSTEM FOR EV CHARGING STATIONS AND NEARBY BATTERY OVERSIGHT

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T J S ENGINEERING COLLEGE

ABSTRACT

The Power Flow Guardian is an advanced Android-based alert system designed to enhance safety and efficiency in electric vehicle (EV) charging stations and surrounding battery operations. It integrates real-time monitoring and proactive alert mechanisms to ensure optimal performance and security. The system's capabilities include continuous surveillance of charging parameters such as voltage, current, and temperature, providing instant notifications and alerts to users and operators in case of abnormalities or potential hazards. By leveraging cutting-edge Android technology, the Power Flow Guardian offers seamless connectivity and user-friendly interfaces, enabling remote oversight and management of EV charging processes. This innovation not only enhances the reliability of charging infrastructure but also promotes sustainable energy practices by ensuring the safe operation of nearby battery systems. With its robust features and proactive safety measures, the Power Flow Guardian sets a new standard in smart technology for EV infrastructure, facilitating a safer and more efficient ecosystem for electric mobility.

SOFTWARE FOR SPEECH LANGUAGE THERAPY CLINICAL SERVICE

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BANNARI AMMAN INSTITUTE OF TECHNOLOGY

ABSTRACT

Speech-Language Therapy Clinical Services play a vital role in the assessment, treatment, and rehabilitation of individuals with speech, language, and communication disorders. Rehabilitation institutes providing these services often handle a high volume of therapy cases with a limited number of qualified supervisors and a larger number of student therapists. In many such institutes, the entire clinical workflow—including patient allocation, therapy planning, session documentation, progress reporting, supervisor review, and clinical evaluation—is still managed manually using paper records or unstructured digital files. This manual approach leads to delays in service delivery, increased administrative workload, difficulty in tracking patient progress over time, and challenges in maintaining consistency and transparency in clinical evaluation. The objective of this project is to design and develop a web-based software system that digitizes the complete speech-language therapy

clinical workflow within rehabilitation institutes. The proposed system provides a centralized platform where patient cases can be systematically allocated to therapists and supervisors, therapy plans with defined goals and activities can be documented, and therapy sessions can be recorded in a structured manner. By digitizing therapy-related documentation, the system ensures that all clinical data is stored securely and can be easily accessed for review and evaluation. A key focus of the proposed solution is to support clinical evaluation of therapy through structured digital records rather than replacing professional judgment. Supervisors can review therapy plans, session logs, and progress reports through the system and provide feedback and clinical ratings based on predefined evaluation parameters. This structured approach improves the quality and consistency of clinical evaluation while reducing reliance on subjective or incomplete records. Basic AI- assisted analysis techniques are incorporated only to support decision-making, such as identifying progress trends and summarizing session data, without performing automated diagnosis or replacing the role of speech-language pathologists. The proposed system improves coordination between therapists and supervisors, reduces manual paperwork, and enhances the efficiency and reliability of clinical services. By maintaining centralized and well-organized clinical records, the software enables better tracking of patient improvement, supports informed clinical decisions, and contributes to improved quality of care. Overall, this project provides a feasible, cost-effective, and scalable digital solution that aligns with real-world clinical practices and addresses the operational challenges faced by rehabilitation institutes in delivering speech- language therapy services.

Digital Footprint Detection and Privacy Risk Analysis System for Web Browsing

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ABSTRACT

In the current age of increasing Internet activity, individual browsers can unintentionally create a massive amount of personal information about themselves when they visit websites. This information is referred to as your digital footprint, and the danger in this is that it can lead to tracking, privacy, and misuse of your personal information. Most people do not understand that websites collect information on user behavior (behavioral tracking) with cookies, third-party outsourcing of tracking systems, Fingerprinting techniques, or by using other methods to track and monitor users. This project will develop a browser extension that allows you to see your digital footprint in real-time to assist you in understanding and monitoring your online privacy exposure. The extension is designed to run in the background and provide analysis of website activity, including the number of cookies that have been created on the site during each visit, tracking scripts used by the site to track visitors, attempts of the browser to create a fingerprint of a user, and patterns of DNS resolution of each website visited. Based on this analysis, the system will evaluate the potential privacy risks associated with visiting that specific website and provide a real-time and dynamic privacy risk score for the site that is currently being visited in the user's web browser. The results of this analysis will be displayed on an interactive dashboard that provides a way to visually see tracking activity, the tracking of specific

risks that were detected, and information about your overall privacy exposure. By providing users of the extension with easy and understandable examples of complex privacy signals to analyze, the extension overall will help users better understand how their personal information is being collected online and will enable them to make safer and more informed decisions regarding their use of the Internet.

Zorvexra: An Ecosystem Driven by Developers for Organized Project Contribution andAutomated Portfolio Creation

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Uppal, Hyderabad, Telangana, India
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Abstract

With its structured weekly contributions, methodical project reviews, and recognition, Zorvexra is a developer-driven platform that fosters a culture of consistent project development. The platform offers a structured ecosystem in which contributors regularly submit projects, while administrators manage repository quality and authenticity. The platform also offers a feature that enables it to automatically build contributor portfolios using their commits, project submissions, and contributor metrics. It will promote a learning and contributing culture while maintaining an internal project repository. To facilitate contributor project submissions and reviews, Zorvexra utilizes modern web technologies, such as frontend frameworks, backend services, and automated workflows. The planned feature set includes analytics-based contributor insights, automated testing frameworks, and artificial intelligence-based code reviews. Zorvexra is a developer-driven platform that fosters a culture of project development through its systematic project reviews, weekly contributions, and recognitions. The platform provides a systematic environment in which administrators are responsible for the authenticity and quality of the repositories, and the contributors are consistent in their contributions of projects to the platform. The platform also has a feature that enables it to generate contributor portfolios through its project contributions, commits, and contributor metrics. The platform will have an internal project repository and a learning and contributing culture.

AI-Based Glaucoma Detection System

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Abstract

Glaucoma is a progressive eye disease that damages the optic nerve and is one of the leading causes of irreversible blindness worldwide. The disease usually develops slowly without noticeable symptoms, making early detection extremely challenging. Traditional diagnostic methods rely on expert ophthalmologists and specialized medical equipment to analyze retinal fundus images, which

may not always be accessible in rural or underdeveloped regions. To address this challenge, this paper proposes a deep learning-based automated system for glaucoma detection using retinal fundus images. The proposed system analyzes retinal images and classifies glaucoma severity into three levels: Low, Moderate, and Critical. Initially, the retinal images undergo preprocessing steps such as resizing, noise removal, and contrast enhancement to improve image quality. Important features such as the optic disc and optic cup regions are extracted from the images for further analysis. A Convolutional Neural Network (CNN) model is trained using labeled retinal datasets to automatically learn patterns associated with different stages of glaucoma. Once trained, the system predicts the severity level of glaucoma for new input images and displays the result through a user-friendly interface. The proposed system assists healthcare professionals by providing faster and more reliable screening, enabling early diagnosis and timely treatment. By reducing dependency on manual examination, this approach improves accessibility to glaucoma screening and helps prevent vision loss. Keywords: Glaucoma Detection, Deep Learning, Convolutional Neural Network, Retinal Fundus Image, Medical Image Processing, Disease Classification, Optic Disc Analysis.

AI-POWERED FRAMEWORKS IN AUTOMOTIVE PRODUCT LIFECYCLE MANAGEMENT: DRIVING DIGITAL TRANSFORMATION IN VEHICLE DEVELOPMENT

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ABSTRACT

The automotive industry faces unprecedented pressure to accelerate innovation cycles, reduce development costs, and transition toward electric and autonomous vehicles. This paper investigates how artificial intelligence (AI)-powered frameworks within Product Lifecycle
Management (PLM) systems can drive digital transformation in automotive vehicle development. Through systematic analysis of AI capabilities and their potential applications in automotive contexts, this research identifies critical success factors and proposes an integrated Automotive AI-PLM Effectiveness Framework. The framework addresses the unique challenges of automotive development including vehicle complexity, multi-tier supplier ecosystems, platform strategies, and stringent safety and regulatory requirements. Key AI capabilities examined include predictive analytics for quality and timeline forecasting, generative design for lightweighting and optimization, process automation for compliance management, and knowledge management for design reuse. The research demonstrates that successful AI-PLM implementation requires digital thread maturity, supplier integration capabilities, engineering culture adaptation, and strategic alignment with electrification and autonomy transitions. The proposed framework provides actionable guidance for automotive manufacturers navigating digital transformation amid technological disruption.

SMART MULTIMODAL EMOTION RECOGNITION SYSTEM FOR HUMANOID AI

Pranov S	Rohith Babu Y

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Abstract

In the real world, most AI systems fail to understand human emotions, leading to unnatural and ineffective human–AI interactions in education, healthcare, and virtual assistance.

This project presents a Smart Multimodal Emotion Recognition System for a Humanoid AI that understands human emotions through text, speech, and facial expressions.

The system uses transformer-based models from Hugging Face for text emotion detection, the open-source OpenAI Whisper model for speech transcription, and facial analysis using Serengil DeepFace. Acoustic features are analyzed using deep learning techniques to identify emotional cues from voice signals.

The detected emotions from all modalities are fused using a weighted decision mechanism to determine the final affective state. The fully open-source architecture enables scalable, cost-effective, and emotionally intelligent humanoid AI interaction for education, virtual assistance, and human-centric applications.

AffectiveSync: A Multimodal AI System for Real-Time Engagement Detection and Adaptive Intervention in Virtual Classroom

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Abstract

The rapid growth of online education has expanded access to learning, yet virtual classrooms often lack the natural, real-time human interaction present in traditional physical classrooms. In traditional settings, instructors naturally gauge student comprehension through non-verbal cues such as facial reactions and expressions, while students can seamlessly seek localized, context-specific assistance from peers or instructors. Conversely, virtual environments often result in one-way lectures where instructors teach to invisible audiences. Students frequently experience social inhibition or "mic-shame," leaving many conceptual doubts unaddressed. Furthermore, technical disruptions or late arrivals can cause learners to miss important parts of the lecture without immediate ways to catch up. To address these challenges, we propose and prototype AffectiveSync, a multimodal intelligence system designed to recreate key aspects of physical classroom interaction within virtual learning environments. Extending beyond face-based detection, AffectiveSync integrates video-based emotion sequence analysis using ViBED-Net, a state-of-the-art model for video-based engagement detection, with cognitive signals derived from emerging keyword trends in live chat (TF-IDF analysis) to identify meaningful teaching moments such as localized conceptual confusion. Crucially, AffectiveSync extends beyond detection to active intervention. Utilizing a session-specific Retrieval-Augmented Generation (RAG) knowledge base driven by live lecture transcriptions and vector-based retrieval, the system allows students to privately pose code-mixed or colloquial queries, receiving contextually accurate answers without interrupting the lecture. Simultaneously, a real-time teacher dashboard correlates collective engagement signals (e.g., confusion or frustration) with lecture progression. This surfaces actionable insights by pinpointing the exact concept causing friction, providing instructors with intuitive cues for timely, adaptive clarification. This architecture transforms passive video lectures into dynamic, two-way educational ecosystems. By bridging affective signals with cognitive learning feedback, AffectiveSync improves understanding while preserving both student dignity and instructor agency.

AI-Based Multi-Layer Bot Detection System for Web Applications

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Karpagam Institute of Technology

Abstract:
This project proposes a powerful full-stack system that ensures the real-time detection of web application bots. The system is developed to protect web applications from malicious bot attacks. Unlike traditional security solutions that may be compromised, the proposed system uses the subtle behavior of the user to accurately identify the type of user. The proposed architecture is based on the client-server model. In the client-side architecture, the application is developed using the React JS library. In addition, the application uses a custom JavaScript library that passively collects user interaction data, including mouse movements, keyboard inputs, and scrolling actions. These actions are used to identify the type of user. After the data is collected, it is periodically transmitted to the server. The server-side architecture is developed using the FastAPI library. In this architecture, the interaction data is processed in real time using a pre-trained XGBoost machine learning algorithm. The algorithm classifies the interaction data into three types: human users, trusted bots, and malicious bots. In addition, trusted bots may use the JWT token-based authentication protocol to bypass the analysis process. All the interaction data is stored in the MongoDB database.

Experimental Investigation of Hybrid nanoparticles enhanced Phase Change Material for Thermal Energy Storage Applications

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Abstract:
Phase change materials (PCMs) have attracted significant attention for thermal energy storage (TES) and release owing to their unique latent heat characteristics. However, their inherently low thermal conductivity limits heat transfer efficiency, resulting in reduced thermal performance. To address this, this study focuses on enhancing heat transfer and energy storage performance by dispersing highly conductive hybrid nanoparticles (multi-walled carbon nanotubes and graphene) with salt hydrate PCM using two-step approach. The thermophysical properties of the nanocomposites, such as thermal conductivity, chemical and thermal stability, were systematically analyzed by using FTIR, thermal conductivity analyzer and thermogravimetric analyzer. Experimental results shows the inclusion of hybrid nanoparticles significantly enhances the thermal conductivity of salt hydrate PCM by 97.77%, increasing from 0.45 W/(m·K) to 0.89 W(/m·K). Furthermore, the developed nanocomposite exhibits excellent thermal stability, maintaining structural integrity up to 460 °C, and the formulated nanocomposite is physically and chemically stable. This enhancement is attributed to the larger surface area of nanomaterials and the formation of well-developed thermal network between the particles, thereby reducing thermal resistance and promoting efficient heat transfer. These findings

demonstrate the potential of developed nanocomposites as a sustainable and high- performance solution for thermal energy storage applications.

Keywords:- Phase change materials; Multi-walled Carbon Nanotubes; Graphene; thermal energy storage; thermal conductivity.

Intent-Guided Answer Generation Using NLP and Machine Learning for Medium- Level Large Language Models

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Saranathan College of Engineering, Tiruchirappalli

Abstract:

Large Language Models (LLMs) are widely used in modern question-answering systems and conversational AI applications. However, many existing systems depend heavily on large-scale LLMs for both intent detection and response generation, which leads to high computational cost and increased processing time. Efficient intent recognition is essential for improving response relevance andreducing unnecessary reliance on large language models. This project proposes an intent-guided answer generation system that combines Natural Language Processing (NLP) techniques and Machine Learning (ML) models with a medium-level LLM for efficient response generation. In the proposed system, user queries are first processed using NLP techniques such as tokenization, stop- word removal, and TF-IDF feature extraction. These processed inputs are then classified using machine learning algorithms such as Logistic Regression, Naïve Bayes, or Support Vector Machine to accurately identify the user's intent. Once the intent is detected, the system generates context-specific prompts that guide a medium-level Large Language Model to produce relevant answers. By separating intent detection from answer generation, the proposed approach reduces computational dependency on large LLMs while improving response accuracy and efficiency. The system is designed to be cost-effective, scalable, and suitable for real-world applications such as educational platforms, intelligent chatbots, and automated question-answering systems. The proposed method aims to improve user satisfaction by delivering more accurate and context-aware responses throughintent-based AI processing.

Non - Invasive Sepsis Detection Using Breath Analysis

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Vel Tech Multi Tech Dr.Rangarajan Dr.Sakunthala Engineering College

Abstract:

This project focuses on developing a non-invasive breath-based biomarker monitoring system for early infection screening. The system uses three gas sensors—MiCS-2714 for Nitric Oxide (NO), MQ-136 for Hydrogen Sulphide (H_2S), and MQ-7 for Carbon Monoxide (CO)—to detect abnormal changes in exhaled breath composition. These signals are processed by an Arduino microcontroller, which converts sensor readings into ppm values and compares them with predefined healthy-breath thresholds. If elevated gas levels are detected, indicating possible infection-related metabolic changes, a buzzer alarm is activated, and an alert message is displayed on a 16×2 I^2C LCD. The system is programmed using Embedded C to ensure real-time data acquisition and reliable sensor integration.

This prototype is designed to be portable, affordable, and easy to operate, enabling quick screening without invasive procedures or laboratory equipment. The project demonstrates how breathsensing technology can support early health monitoring and rapid triage in critical and remote care environments.

A Context-Aware Intelligent Traffic Sign and Zone Alert System Based on Time and Weather Conditions

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Abstract:

Traffic signs are essential for maintaining road safety and regulating traffic flow, but conventional traffic sign recognition systems mainly focus on visual detection without considering real-world contextual factors. This paper presents a Context-Aware Traffic Sign and Zone Alert Intelligence System based on Time and Weather Conditions, designed to enhance driver awareness by integrating traffic sign recognition with environmental context analysis. The proposed system detects and classifies traffic signs using a YOLOv8-based deep learning model trained on open-source traffic sign datasets for accurate real-time recognition. In addition to sign detection, the system incorporates contextual parameters such as time of
day and real-time weather conditions obtained through system time and public weather APIs. These contextual features are analyzed using machine learning models including Random Forest and XGBoost to evaluate the severity of traffic situations and generate appropriate alerts. Based on the analyzed context, the system produces dynamic text notifications and multilingual voice alerts using Text-to-Speech (TTS) technology to assist drivers in understanding road conditions more effectively. A web-based dashboard developed using Python (Flask), HTML, CSS, and JavaScript provides an interactive interface for displaying detected traffic signs, contextual information, and alert notifications in real time. By combining deep learning, machine learning, and context-aware decision mechanisms, the proposed system contributes to the development of intelligent transportation solutions that support safer and more adaptive road environments Keywords— Traffic Sign Recognition, YOLOv8,Context-Aware Systems, Intelligent Transportation Systems, Deep Learning, Weather-Aware Alerts, Multilingual Voice Alerts.

AI-Based Crowd Density Prediction and Monitoring System

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Abstract:

Crowd management is a critical challenge in public places such as railway stations, malls, stadiums, temples, and large public events. Excessive crowd density can lead to dangerous situations including

stampedes, accidents, and delayed emergency responses. Traditional monitoring systems rely heavily on manual surveillance through CCTV cameras, which is inefficient, time-consuming, and incapable of providing real-time analytical insights. To address these limitations, this work proposes an AI-based real-time crowd density prediction and monitoring system that automatically detects and analyzes crowd levels using deep learning techniques. The proposed system utilizes the YOLOv8 object detection model to accurately detect and count individuals from live camera feeds. Video frames captured through OpenCV are processed in real time to calculate crowd density and classify the crowd level into categories such as Low, Medium, and High. When the crowd density exceeds predefined safety thresholds, the system triggers automated alerts to notify authorities. The system also provides a web-based dashboard developed using React and Django, allowing administrators to monitor live video streams, view real-time metrics, and analyze historical crowd data. Experimental results demonstrate that the system achieves efficient real-time performance with accurate person detection and low latency video streaming. The proposed solution offers a cost-effective, scalable, and intelligent alternative to traditional surveillance systems, enabling proactive crowd management and improved public safety. This system can be deployed in various environments including transportation hubs, public events, and commercial spaces to assist authorities in preventing overcrowding incidents and ensuring safer public environments.

Real-World Noise-Robust Audio Classification Using Deep Learning

Jayanthan RM | **Jennifer Rubina J** | **Linkesh VB**

Saranathan College of Engineering

Abstract:

While recent AI models perform exceptionally good in audio classification under controlled or noise free environment, they fail when they are tested against the real-world audio filled with noise and irregularities. Not because the models used are wrong nor that the data is wrong, it is just that they are trained wrong. The data used to train these models is not is the one found in real world. A model can only perform good in real world noise only if it is exposed to it, and that is the aim of our study, training an AI model with noisy data to mimic the data found in real world. As a solution to this limitation, in this study we propose a lightweight hybrid CNN–Self-Attention architecture (Convolution Neural Network) designed for noise-robust environmental sound classification. Unlike previous approaches, we add noise to the audio sample, making the audio sample noisy. The noisy audio is fed into to Long-Mel Spectrogram to convert the audio signals into a 2D matrix which can be processed by CNN to classify the audio. The performance is measured by using metrics like accuracy, precision, confusion matrices under varying noise conditions, while having clear audio as the baseline performance. By integrating noise aware training with a light weight model, we aim to reliably classify audio while requiringcomputation as little as possible.

A Context-Aware Confidence-Score Based Autoscaling Framework for Cloud Computing Environments

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Abstract:

Cloud computing environments host a wide variety of applications that experience highly dynamic and unpredictable workloads. Efficient resource management is essential to maintain system

performance while minimizing operational costs. Autoscaling mechanisms dynamically adjust computing resources according to workload demand, ensuring compliance with Service Level Agreements (SLAs). However, traditional reactive autoscaling approaches that rely on instantaneous system metrics such as CPU utilization often lead to delayed scaling actions, unnecessary scaling oscillations, and frequent SLA violations during sudden workload spikes. To address these limitations, this paper proposes a Context-Aware Confidence-Score Based Autoscaling Framework designed to improve the reliability and stability of autoscaling decisions in cloud data centers. The proposed framework introduces a sliding-window workload analysis technique that monitors recent CPU utilization trends and computes statistical measures such as average utilization and standard deviation. Based on these metrics, a confidence score is calculated to evaluate the stability and reliability of the current workload pattern before initiating scaling operations. The framework distinguishes between short-term workload spikes and sustained demand changes, thereby preventing unnecessary scaling operations triggered by temporary fluctuations. Autoscaling decisions are made using a confidence-aware decision engine that integrates workload stability analysis with SLA evaluation. When high confidence in workload stability is detected along with SLA violations, the system performs scale-up operations. Conversely, when workload demand decreases with stable conditions, the system initiates scale-down actions. This mechanism ensures balanced resource provisioning while maintaining system performance. The proposed framework was implemented and evaluated using the CloudSim simulation toolkit, which enables realistic modeling of cloud environments and workload patterns. Experimental evaluations were conducted using dynamically generated workloads and compared against a conventional rule-based autoscaling model. Key performance metrics including SLA violation count, response time stability, scaling action frequency, and resource utilization efficiency were analyzed. Results demonstrate that the proposed confidence-aware autoscaling framework significantly improves system performance compared to traditional reactive approaches. The framework reduces SLA violations, maintains stable response times under fluctuating workloads, and minimizes unnecessary scaling actions. Additionally, it achieves higher resource utilization efficiency while maintaining low computational overhead, making it suitable for real-time cloud environments. Overall, the proposed approach offers a lightweight, interpretable, and efficient autoscaling solution for modern cloud infrastructures dealing with dynamic workloads. Future work may extend the framework by incorporating additional system metrics such as memory, network bandwidth, and I/O usage, as well as evaluating its performance in real-world cloud platforms and containerized environments such as Kubernetes.

NEUROSCENT: AN OLFACTORY – DRIVEN SMART HEALTHCARE SYSTEM FOR ALZHEIMER PATIENT'S THERAPY AND REMOTE MONITORING

Malarvizhi	Reeja Merlin	Jessica Jebin	Navi Raj	Shanker

Vel Tech Multi Tech Dr Rangarajan Dr Sakunthala Engineering College

Abstract:

This project presents NEUROSCENT, an innovative olfactory-based neurorehabilitation system designed to help Alzheimer's patients through sensory stimulation and physiological monitoring. The system combines an Arduino Mega with sensors like the DHT11 for tracking the environment and a heart rate sensor for real-time physiological data. By analyzing the input through software, the system

detects cognitive responses and activates a DC air pump motor when needed to release therapeutic fragrances through a perfume setup. GSM and ESP8266 modules support communication and control for remote monitoring, and an I2C LCD provides feedback on-site. Motor drivers handle actuator control, and RS232 ensures reliable data interfacing. Neuroscent aims to improve memory recall and emotional stability in Alzheimer's patients by connecting olfactory stimuli with neurological signals to enhance neurotherapy outcomes. Alzheimer's disease causes progressive memory loss and cognitive decline, affecting millions of people worldwide. Traditional therapies mainly focus on medication and cognitive exercises, but recent research shows that sensory stimulation, especially olfactory therapy, is important for improving memory recall and emotional well-being.

Keywords - Alzheimer's disease; Olfactory Therapy; Neurorehabilitation;Embedded Systems; Physiological Monitoring; Smart Healthcare.

PREDICTIVE MAINTENANCE FOR SMART MANUFACTURING USING AI

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Abstract:

The main objective of this paper is to find the best solution for the smart industries to work longer without failure of machinery. It increases efficiency of operational machinery .We are choosing a strategy called predictive maintenance with advancement of AI. Currently industries are becoming more automated (using smart technology) which is already a large investment .Spending alot on machinery and facing a downfall due to its failure is a big ban and leads the industries to shutdown. There are some traditional methods (reactive and predictive maintenance) to escape from the situation, they are just escaping ideas, but not the ideal solutions. Reactive maintenance: According to this strategy , the initiative is taken after the failure of the machines. This is not ideal as the loss is irretrievable. Preventive maintenance: This is the method where machinery is serviced at regular time periods. This leads to unnecessary investment on preliminarily good equipment. We chose predictive maintenance inorder to solve this problem in an optimal way.

Methodology to predict the machine failures before they happen:

1. MACHINE LEARNING ALGORITHM
2. DEEP LEARNING METHODS
3. IOT FOR SENSORS

Finally through this approach we can see increase equipment's lifetime in smart factories.

More efficiency, more output, more profit.

Graph-Based Dynamic Traffic Routing for Smart Cities Using Sensor-Driven Edge Weight Optimization

Vallapu Shiva Shankar	**Mr. Kishore**

Aurora Deemed to be university

Abstract:
Rapid urbanization has significantly increased traffic congestion in modern cities, leading to longer travel times, increased fuel consumption, and environmental pollution. Traditional traffic signal systems rely on fixed timing mechanisms that do not adapt to real-time traffic conditions. This paper proposes a graph-based dynamic traffic routing system for smart cities, where urban road networks are modeled using graph theory. Intersections are represented as vertices and roads as weighted edges. Real-time traffic density data obtained from sensors is used to dynamically adjust edge weights, enabling optimal path computation using Dijkstra's shortest path algorithm. The proposed system integrates embedded sensors, microcontrollers, and graph algorithms to dynamically optimize traffic routing and signal timing. Experimental simulations demonstrate that the system can significantly reduce congestion and improve traffic flow efficiency compared to traditional fixed-time traffic control systems. The proposed approach highlights the potential of combining discrete mathematics and intelligent infrastructure for developing efficient smart city transportation systems.
Keywords: Smart City Traffic Management, Graph-Based Algorithms, Dijkstra's Algorithm, Real-Time Traffic Routing, Intelligent Transportation Systems, Embedded Sensor Networks, Dynamic Traffic Signal Control.

INTELLIGENT BATTERY MANAGEMENT SYSTEM WITH AI-DRIVEN ENERGY CONTROL MODULE FOR ELECTRIC VEHICLES

Manikandan. D	Ganesh Kumar. J	Gowtham. G	Siva. S	Rengarajan. V

Velammal Engineering College

Abstract:
This project focuses on the design and development of an Intelligent Battery Management System (BMS) with AI-driven energy control for electric vehicle applications. The main objective of the system is to improve battery safety, performance, and lifespan by continuously monitoring important battery parameters such as State of Charge (SOC), State of Health (SOH), voltage, current, and temperature using embedded sensors and microcontroller technology. By observing these parameters in real time, the system helps users understand the battery's operating condition and detect potential problems at an early stage. To represent realistic electric vehicle operating conditions, a DC motor is used as a dynamic load, which allows the system to analyze battery behavior during actual discharge and operation. The sensor data is processedusing Python-based algorithms to estimate SOC and evaluate battery health by analyzing discharge patterns, voltage fluctuations, temperature variations, and overall battery performance over time. The processed information is displayed on an interactive dashboard, making it easy for users to visualize battery status and performance trends. In addition, the system can be integrated with an IoT platform for remote monitoring, data logging, and alert notifications. This approach helps improve battery health monitoring, supports predictive maintenance, optimizes energy usage, and ultimately extends the operational life of electric vehicle batteries.

A Hybrid AI-Based Approach for Real-Time Phishing URL Detection

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Velammal Institute of Technology

R P Sarathy Institute of Technology

Abstract:
Phishing attacks using deceptive URLs remain one of the most serious cybersecurity threats, exploiting user trust and continuously evolving attack strategies. Traditional phishing detection techniques, such as blacklist-based and rule-based methods, are ineffective against newly generated and zero-day phishing URLs due to their reliance on previously known patterns. Although machine learning and deep learning approaches have improved phishing detection accuracy, many existing systems suffer from limited adaptability and high false positive rates when facing emerging phishing techniques. To address these challenges, this paper proposes an enhanced hybrid AI-based framework for real-time phishing URL detection. The proposed system integrates structural URL feature analysis with contextual deep learning representations to capture both lexical characteristics and hidden semantic patterns in URLs. An ensemble learning approach is employed to improve classification robustness and accuracy, while an anomaly detection mechanism is incorporated to identify previously unseen phishing URLs. The framework also supports periodic model retraining to adapt to evolving phishing strategies. The proposed system is implemented as a web-based real-time detection platform and evaluated using publicly available phishing URL datasets. Experimental results demonstrate improved detection accuracy, reduced false positives, and enhanced robustness compared to conventional phishing detection approaches, highlighting the effectiveness of hybrid and adaptive intelligence for real-world cybersecurity applications.

BugBuster AI

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Kamaraj College of Engineering and Technology

Abstract:
In modern software development, maintaining code quality, readability, and proper documentation is essential for efficient project management and future maintainability. Developers often write functions, methods, or classes without sufficient comments or docstrings, which can lead to confusion and errors in collaborative projects. BugBuster Code Analyzer is a web-based tool designed to automatically analyze source code files written in Python, Java, and C. The system allows users to upload individual code files, entire folders, or compressed ZIP archives. Once uploaded, the tool scans only the supported programming language files and detects issues such as missing function or class documentation, empty files, or structural errors. Each identified issue is categorized based on severity—High, Medium, or Low—helping developers prioritize code improvements effectively. Built on the Django framework, BugBuster uses language-specific parsing techniques for Python, Java, and C, providing actionable insights that streamline the code review process and ensure adherence to best coding practices. The tool not only saves valuable time in manual reviews but also improves software maintainability, enforces coding standards, and promotes consistent documentation across projects. By supporting multiple languages and file upload formats, BugBuster offers a versatile and practical solution for individual developers and development teams aiming to enhance code quality efficiently.
Keywords: Static Code Analysis, Bug Detection, Multi-Language Support, Code Quality, Software Maintainability, Django Framework, Severity Classification, Documentation Checking, Automated Code Review, Python AST Analysis.

Topology-Optimized Fiber Metal Laminates: Computational Design Strategies for Lightweight and Damage-Tolerant Structures

T Rao Surtani, 2 Logesh K, 3 Hariharasakthisudhan Ponnarengan
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Abstract:
Achieving high structural efficiency while minimizing weight remains a central challenge in aerospace and transportation engineering. Fiber metal laminates offer an advantageous combination of metallic ductility and composite stiffness; however, conventional laminate architectures often rely on empirical design strategies. Topology optimization provides a computational framework for systematically designing material architectures that maximize mechanical performance within prescribed constraints. This review examines recent advances in topology-driven design approaches applied to hybrid laminate systems. Various optimization methodologies—including density-based algorithms, level-set techniques, and evolutionary search strategies—are discussed in the context of optimizing metal distribution, fiber orientation, and laminate stacking sequences. The integration of topology optimization with finite element analysis enables the exploration of novel laminate configurations that enhance stiffness-to-weight ratio, energy absorption capacity, and damage tolerance. The review also highlights studies in which computational optimization has been used to design laminate architectures resistant to impact damage and fatigue crack propagation. Emerging developments in multi-objective optimization frameworks and machine learning-assisted design methodologies are also considered. Despite the promising capabilities of topology optimization, practical challenges related to manufacturability constraints and computational complexity remain significant. Advances in digital manufacturing and additive fabrication technologies are expected to facilitate the realization of optimized laminate geometries. By synthesizing developments across computational mechanics and materials engineering, this review provides insights into the future of data-driven structural design for advanced fiber metal laminate systems.
Keywords: Topology optimization; Fiber metal laminates; Structural design; Computational materials engineering; Lightweight structures

Design/Development of an efficient Energy Storage System (ESS) to integrate intermittent Renewable Energy sources and to support/stabilize the grid.

THANIKSHA P R	SANJAY K	TAMILVASANTH S

BANNARI AMMAN INSTITUTE OF TECHNOLOGY

Abstract:
With the rapid growth of renewable energy integration, efficient control and optimization of grid-connected solar PV systems have become critical. This project focuses on developing a software-based intelligent control algorithm for a two-stage three-phase grid-connected PV system. The first stage involves implementing and comparing advanced Maximum Power Point Tracking (MPPT) algorithms such as Particle Swarm Optimization (PSO) and Perturb & Observe (P&O) to maximize power extraction under dynamically changing irradiance and temperature conditions. The second stage includes coding a grid synchronization and current control strategy using dq-axis transformation and Phase-Locked Loop (PLL) techniques to ensure stable and low-harmonic power

injection into the grid. The system is modeled and simulated in MATLAB/Simulink, where performance metrics such as efficiency, Total Harmonic Distortion (THD), power factor, and response time are analyzed. The proposed coding framework enhances system stability, tracking accuracy, and overall energy conversion efficiency, making it suitable for smart grid applications.

KEYWORDS : Grid-Connected PV System, Two-Stage Converter, DC–DC Boost Converter, Three-Phase Inverter, Advanced MPPT, PSO, P&O, dq Control, Phase-Locked Loop (PLL), THD Reduction, MATLAB/Simulink, Smart Grid Integration.

Thermoplastic Fiber Metal Laminates for Sustainable Aerospace Structures: Processing Innovations and Recyclability

A Backiaraj	Logesh K	Hariharasakthisudhan Ponnarengan

Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology

Abstract:
Sustainability considerations are increasingly influencing the selection of structural materials in aerospace and transportation industries. Thermoplastic fiber metal laminates have emerged as a promising alternative to traditional thermoset-based laminates due to their improved recyclability, weldability, and resistance to impact damage. This review examines recent progress in thermoplastic-based FML systems fabricated using matrices such as polyether ether ketone (PEEK), polyphenylene sulfide (PPS), and polyetherimide (PEI). The influence of thermoplastic matrices on laminate toughness, fatigue performance, and impact resistance is discussed in comparison with conventional thermoset laminates. Advanced processing techniques—including hot pressing, induction welding, automated tape placement, and thermoforming—are reviewed for their potential to enable rapid manufacturing of high-quality laminates. Particular emphasis is placed on recycling strategies that allow thermoplastic laminates to be reprocessed or remolded without significant degradation in performance. Environmental and life-cycle assessment studies are also discussed to evaluate the sustainability benefits of thermoplastic FML systems. Challenges related to high processing temperatures, metal–polymer compatibility, and large-scale industrial manufacturing remain key areas of research. Emerging developments such ashybrid thermoplastic architectures and automated manufacturing technologies are expected to accelerate the adoption of these materials in aerospace structures. This review provides a comprehensive assessment of thermoplastic FML technologies and their potential contribution to sustainable structural engineering.
Keywords:
Thermoplastic composites; Fiber metal laminates; Sustainable materials; Aerospace manufacturing; Recyclable composites.

Bio-Inspired Fiber Metal Laminates: Hierarchical Architectures for Enhanced Impact and Fracture Resistance

1 Chandrasekar L, 2 Logesh K, 3 Hariharasakthisudhan Ponnarengan
Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology

Abstract:
Natural structural materials such as nacre, bone, and arthropod exoskeletons exhibit remarkable toughness and damage tolerance due to their hierarchical organization across multiple length scales. Inspired by these biological systems, researchers have begun exploring biomimetic design strategies for improving the structural performance of fiber metal laminates. This review provides a comprehensive overview of bio-inspired laminate architectures developed to enhance impact resistance and fracture toughness in hybrid metal–composite systems. Various hierarchical design concepts including staggered brick- and-mortar arrangements, gradient interfaces, and layered microstructures are analyzed for their potential to improve energy dissipation and crack deflection mechanisms. Experimental studies investigating the mechanical response of biomimetic laminates under tensile, flexural, and impact loading are critically examined. The review also discusses how interfacial sliding, crack bridging, and progressive delamination contribute to improved damage tolerance in bio-inspired architectures. Computational modeling approaches used to simulate hierarchical fracture behavior are presented alongside experimental characterization techniques such as scanning electron microscopy and digital image correlation. Manufacturing challenges associated with replicating complex biological architectures at engineering scales are also considered. Advances in additive manufacturing and advanced laminate processing techniques may enable more precise control over hierarchical structural features. The review concludes by identifying future research opportunities in multi-scale biomimetic design and hybrid laminate architectures aimed at developing next-generation FML structures with superior resistance to catastrophic failure.
Keywords: Bio-inspired composites; Fiber metal laminates; Hierarchical structures; Fracture toughness; Impact resistance

Smart In-Pipe Energy Harvesting System

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NPR College of Engineering and Technology , Natham, Tamil Nadu, India

Abstract:
This paper presents a compact Smart In-Pipe Energy Harvesting System designed to convert the kinetic energy of flowing water in pipelines into usable electrical energy. The proposed system integrates a micro helical turbine installed inside a water pipeline, which captures the hydraulic energy of flowing water and converts it into rotational mechanical energy. A gear transmission mechanism is incorporated between the turbine shaft and the DC generator to enhance rotational speed, thereby improving electrical power generation efficiency under low-flow conditions. The generated mechanical energy is converted into electrical energy using a permanent magnet DC generator and processed through a rectification and voltage regulation circuit. The developed system also incorporates voltage and current monitoring modules to evaluate the electrical output generated from the turbine system. The measured parameters are displayed through a digital display unit for real-time observation and
performance analysis. Experimental evaluation indicates that the turbine-gear configuration

significantly improves generator speed and output voltage compared to direct coupling mechanisms .The proposed design emphasizes compact structure, low cost, and ease of installation in existing pipeline networks without interrupting normal water flow. This approach demonstrates an effective method for recovering unused hydraulic energy from water distribution systems and utilizing it for powering small electronic loads and monitoring devices. The proposed system provides a practical solution for micro-scale renewable energy harvesting in pipeline infrastructures. Keywords: Energy Harvesting, Micro Hydropower, In-Pipe Turbine, Gear Transmission, Renewable Energy, Pipeline Power Generation. Expected Outcome:

1. This study aims to demonstrate the feasibility of a compact in-pipe micro hydropower generation system capable of converting the kinetic energy of flowing water into usable electrical energy. By integrating a helical turbine mechanism with a gear transmission system, the proposed design is expected to enhance the rotational speed of the generator shaft, thereby improving the electrical power output even under low- flow pipeline conditions.
2. The developed prototype is anticipated to produce a measurable electrical output voltage in the range of 5–12 V depending on the water flow rate and turbine efficiency. The incorporation of a gear arrangement between the turbine and the DC generator is expected to increase generator speed and improve energy conversion efficiency compared to direct coupling systems.
3. The system also integrates voltage and current monitoring modules, enabling real- time observation of electrical parameters generated from the turbine system. These measurements will be displayed through a digital display unit, allowing performance evaluation and analysis of power generation under varying flow conditions.
4. Furthermore, the proposed system is designed to be compact, cost-effective, and easy to install within existing water pipelines without significantly affecting the normal water flow. The results of this study are expected to demonstrate that small-scale pipeline energy harvesting systems can serve as a reliable renewable energy source for powering low-power electronic devices, sensors, and monitoring systems.
5. Overall, this research contributes to the development of sustainable micro-energy harvesting technologies and highlights the potential of utilizing unused hydraulic energy available in water distribution networks.

Development and Field Performance Analysis of a Solar Powered IoT-Enabled Smart Beehive Monitoring System for Precision Apiculture

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Kongunadu College of engineering and technology

Abstract:

Beekeeping is an important agricultural activity that supports crop pollination and honey production. The health and productivity of a bee colony depend greatly on environmental conditions inside the hive such as temperature humidity, sound and weight. In traditional beekeeping, these conditions are usually checked manually, which may disturb the bees and does not allow continuous monitoring. This system developed to monitor important hive conditions automatically using sensors. Sensors are used to measure parameters such as temperature and humidity inside the beehive. The collected data helps beekeepers understand the condition of the hive and take necessary actions to maintain a suitable environment for the bees. It is powered by solar energy, making it suitable for remote areas

where electricity supply is limited. A solar panel provides power to the monitoring system, ensuring continuous operation while reducing dependence on conventional power sources. This makes the system energy-efficient and environmentally friendly. It supports modern beekeeping practices and contributes to better colony health and productivity.

Keywords: Solar Power, Smart Beehive System, Temperature Sensor, Humidity Sensor, Apiculture Automation, Renewable Energy, Bee Colony Health.

EDUMENTOR: A Retrieval-Augmented Local LLM Framework for Syllabus-Grounded Academic Assistance and Automated Answer Evaluation

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Abstract:

Large language models (LLMs) have recently enabled conversational systems capable of assisting students in academic learning. However, most existing AI tutoring platforms rely on cloud-hosted models trained on general knowledge corpora, which often produce responses that are not aligned with institutional syllabi. Also, unrestricted language models may generate hallucinated explanations and raise privacy concerns when deployed for educational environments. This paper explains about EDUMENTOR, a retrieval-augmented academic assistant designed to provide syllabus-grounded explanations and automated answer evaluation through locally deployed language models. The proposed system is a combination ofquantized Mistral-7B language model with a retrieval-augmented generation (RAG) pipeline based on SentenceTransformer embeddings to ensure that responses remain consistent with faculty-provided academic material. This architecture operates within a local client–server environment, enabling multiple users to interact with the system without relying on external cloud APIs. It also incorporates an automated answer evaluation module that analyzes student responses using optical character recognition and language model reasoning to generate structured feedback. Experimental observations demonstrate that contextual retrieval significantly improves response relevance and enables reliable academic assistance within institutional settings. The proposed approach illustrates how locally deployed LLM systems can be transformed into practical academic assistants capable of supporting both learning and automated assessment.

Keywords—Large Language Models, Retrieval-Augmented Generation, Intelligent Tutoring Systems, Automated Answer Evaluation, Educational AI.

CRITICAL REVIEW ON PINEAPPLE LEAF FIBER (PALF) AND RAMIE NATURAL FIBER COMPOSITES: OPPORTUNITIES, INTERFACIAL CHALLENGES, AND PATHWAYS TO HIGH-PERFORMANCE SUSTAINABLE MATERIALS

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Abstract:

The urgent need for lightweight, low-carbon, and sustainable engineering materials, especially for automotive, building, and consumer product applications, has accelerated the development of lignocellulosic fiber-reinforced polymer composites. Among natural reinforcements, pineapple leaf

fiber (PALF) and ramie fiber have received exceptional attention due to their high cellulose content, low microfibrillar angle, and excellent intrinsic mechanical performance. However, despite significant progress, the widespread industrial application of PALF- and ramie-based composites is limited by hydrophilicity-driven interfacial debonding, moisture-assisted aging, and inconsistent property regeneration in processing routes. This critical review systematically synthesizes and evaluates recent advances in PALF and ramie composite systems, covering fiber structure-property relationships, chemical and green surface modification strategies, composite manufacturing dependencies, durability degradation mechanisms, and life cycle stability. Special attention is paid to interface engineering, where alkaline treatment improves surface cleanliness and increases ramie crystallinity, while silane functionalization strengthens fiber-matrix compatibility through chemical bridging. In addition, emerging environmentally benign treatments such as enzymatic, plasma, and hybrid eco-functionalization routes are critically evaluated as next-generation solutions. This review highlights key process-property trade- offs, showing that high-performance manufacturing methods often induce fiber degradation and reduce reinforcement performance, while hybridization with synthetic fibers improves moisture resistance and structural reliability. The novelty of this work lies in providing an integrated structure-interface-processing-durability-LCA framework to map interface strategies and processing routes for both long-term performance stability and environmental impact. Finally, future research directions are proposed towards recyclable bio-thermoplastic matrices, nanotechnology-enabled interface barriers, and standardized standardization platforms to accelerate the safe commercialization of PALF- and ramie-reinforced composites in high-value structural sectors.
Keywords: Pineapple Leaf Fiber (PALF); Ramie; Natural Fiber Composites; InterfacialAdhesion; Surface Modification; Hybrid Composites; Life Cycle Assessment; Durability.

Hybrid Natural Fiber Metal Laminates: Sustainable Architectures for Lightweight Structural Applications

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Abstract:
Environmental sustainability has become an increasingly important consideration in the development of advanced structural materials. Hybrid laminates incorporating natural fibers as reinforcement phases offer a promising pathway toward reducing the environmental footprint of fiber metal laminate systems. Natural fibers such as flax, jute, hemp, and basalt possess attractive mechanical properties, low density, and renewable availability, making them viable alternatives to synthetic reinforcements in certain applications. This review examines the development of natural fiber-reinforced FML systems designed to combine structural performance with environmental sustainability. The mechanical behavior of these hybrid laminates under tensile, flexural, and impact loading conditions is critically evaluated. Processing techniques used to integrate natural fiber composites with metallic skins—including chemical surface treatments, hybrid stacking sequences, and bio-based matrix systems—are discussed. Particular attention is given to challenges related to moisture absorption, fiber variability, and long-term durability. Advances in surface modification techniques aimed at improving fiber–matrix adhesion and environmental resistance are also reviewed. Environmental benefits of natural fiber laminates are assessed through life-cycle analysis studies comparing them with conventional synthetic fiber laminates. While natural fiber systems may exhibit lower stiffness compared with high-performance composites, their sustainability advantages make them attractive for secondary structural components in automotive, marine, and infrastructure applications. Future research directions include the development of hybrid architectures that combine natural and synthetic

fibers to balance sustainability and structural performance.

Keywords: Natural fibers; Sustainable composites; Fiber metal laminates; Green materials; Hybrid laminates.

Next-Generation Fiber Metal Laminates with Additively Manufactured Core Architectures: Design, Manufacturing, and Mechanical Performance

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Abstract:

Fiber metal laminates (FMLs) have traditionally relied on layered metallic sheets and fiber- reinforced polymer plies to achieve a balance between stiffness, fatigue resistance, and damage tolerance. Recent advances in additive manufacturing (AM) have opened new possibilities for embedding architected core structures within laminate systems, enabling the development of next-generation FMLs with tailored mechanical responses. This review critically examines the emerging integration of additively manufactured cellular cores including lattice frameworks, auxetic geometries, and graded elastomeric architectures within hybrid laminate configurations. The role of AM technologies such as fused filament fabrication, selective laser melting, and directed energy deposition in producing complex core geometries compatible with metallic skins and composite plies is analyzed. Particular attention is given to how core topology, relative density, and interface bonding influence stiffness distribution, energy absorption capacity, and progressive damage evolution during impact and fatigue loading. The review also synthesizes current experimental and computational studies that evaluate the structural behavior of architected FML systems using advanced finite element simulations and multi-scale modeling approaches. Manufacturing challenges associated with thermal mismatch, residual stresses, and scalable production are discussed in detail. In addition, emerging concepts such as topology-driven laminate architectures, multi-material printing, and digital manufacturing workflows are examined as pathways for designing structurally efficient hybrid materials. By consolidating recent progress across materials engineering, additive manufacturing, and structural mechanics, this review highlights the transformative potential of architected FML systems for aerospace sandwich structures, crashworthy automotive components, and next-generation lightweightstructural platforms.

Keywords: Fiber metal laminates; Additive manufacturing; Architected core structures; Impact energy absorption; Hybrid structural materials.

Design and Estimation of LED Billboard structures Using Tekla Software

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Abstract:

The increasing demand for large-scale digital advertising has made structural safety, durability, and cost-effectiveness critical in the design of outdoor LED estimation of a steel-framed LED billboard structure using Tekla Structures software. The design process integrates structural modeling, load analysis, and detailing of connections to ensure stability under dead loads, live loads, and

environmental effects such as wind pressure. Tekla's 3D modeling environment enables accurate visualization, detection of clashes, and generation of fabrication drawings. Material take-off and cost estimation are derived directly from the model, ensuring precision in project planning and resource management. The proposed methodology highlights the advantages of Building Information Modeling (BIM) tools in improving structural reliability, reducing errors in fabrication, and optimizing overall project costs. This work demonstrates how Tekla-based modeling provides an efficient and practical solution for the safe and economical construction of modern LED billboard structures.

Ai Powered Hybrid Framework for skin disease identification using Hyper-CNN

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Abstract:

Automated skin disease classification using dermoscopic images has gained significant attention due to the rising incidence of skin-related disorders and the need for early diagnosis. However, the complex visual patterns of skin lesions, including variations in color, texture, shape, and scale, make accurate classification a challenging task. Conventional convolutional neural networks (CNNs) often suffer from limited feature representation and poor generalization when dealing with such high intra-class variability. To address these challenges, this paper proposes an AI-powered hybrid deep learning framework combining Hyper-Convolutional Neural Networks (Hyper-CNN) and Efficient Net for robust skin disease identification. In the proposed approach, Efficient Net is employed as a powerful feature extractor due to its compound scaling strategy, which efficiently balances network depth, width, and resolution to capture high-level semantic features from skin lesion images. These extracted features are further enhanced using a custom-designed Hyper-CNN architecture, which incorporates deeper convolutional blocks, batch normalization, and adaptive dropout mechanisms to learn fine-grained dermatological patterns. The hybrid framework enables effective extraction of both global and local lesion characteristics, improving discriminative capability across multiple skin disease classes. The proposed model is evaluated using the HAM10000 skin lesion dataset, achieving improved classification accuracy, stability, and confidence scores compared to traditional CNN-based methods. Experimental results demonstrate that the integration of Efficient Net with Hyper-CNN significantly enhances feature representation, reduces overfitting, and improves generalization performance. The proposed hybrid framework provides a reliable and scalable solution for automated skin disease diagnosis and has strong potential for deployment in real-time clinical decision-support systems
Keywords: Skin disease classification, dermoscopic images, deep learning, EfficientNet, Hyper-Convolutional Neural Network (Hyper-CNN), hybrid model, medical image analysis, automated diagnosis, HAM10000 dataset.

Graphene and 2D Nanomaterial Reinforced Fiber Metal Laminates: Interfacial Engineering, Multifunctionality and Structural Performance

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Abstract:

The mechanical efficiency and durability of fiber metal laminates depend strongly on the integrity of interfaces between metallic layers, adhesive films, and fiber-reinforced composite plies. In recent years, the incorporation of graphene and other two-dimensional (2D) nanomaterials into laminate interfaces has emerged as a promising strategy to enhance interfacial strength while introducing multifunctional capabilities. This review examines the role of graphene nanoplatelets, MXenes, boron nitride nanosheets, and transition-metal dichalcogenides as nanoscale modifiers within FML systems. The mechanisms through which these nanomaterials improve adhesion, suppress interfacial delamination, and enhance crack bridging are discussed with emphasis on nanoscale load transfer and energy dissipation processes. Recent experimental investigations demonstrating improvements in tensile strength, flexural stiffness, fatigue resistance, and impact performance of nano-engineered laminates are systematically reviewed. In addition to structural reinforcement, the review highlights multifunctional attributes introduced by 2D nanomaterials, including electrical conductivity, thermal management, and electromagnetic interference shielding. Processing strategies for achieving homogeneous dispersion of nanomaterials in adhesive layers and composite matrices are analyzed, alongside their influence on laminate microstructure and fracture behavior. Current challenges related to nanoparticle agglomeration, interfacial compatibility, and scalable manufacturing remain critical barriers to industrial adoption. Emerging characterization techniques such as nanoscale imaging and multiscale computational modeling are also discussed as tools for understanding interfacial phenomena. The review concludes by identifying opportunities for hybrid nanomaterial systems and multifunctional laminate architectures aimed at expanding the technological capabilities of advanced FML structures.

Keywords: Graphene reinforcement; Fiber metal laminates; Interfacial engineering; Nanostructured composites; Multifunctional materials.

XGNN: Explainable Heterogeneous Graph Neural Network for Drug Repurposing

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Abstract:

De novo drug discovery demands over $2 billion and 12-15 years per approved compound, making computational drug repurposing an urgent clinical and economic priority. Existing graph- based repurposing methods are limited by small homogeneous graphs, unimodal drug representations, and opaque predictions that cannot be traced to biological mechanisms. We address these gaps through XGNN, a heterogeneous graph neural network pipeline integrating multi-source biomedical knowledge across one of the largest and most diverse knowledge graphs reported in drug repurposing literature. XGNN constructs a heterogeneous knowledge graph of 3,105 drugs,20,431 proteins, and 21,776 diseases connected by over 1.15 million typed relational edges from 12 curated databases including OpenTargets, DrugCentral, STRING, Reactome, and CTD. Nodes are represented through rich multi-modal embeddings - 3,794- dimensional drug features, 1,255-dimensional protein features, and 768-dimensional BioBERT disease embeddings trained on 21,895 clinically validated drug-disease associations under zero-leakage stratified splits. A Graph Attention Network-based

HeteroConv architecture further generates attention-weight-based mechanistic explanations tracing each prediction through the protein interactome, bridging predictive performance with clinical interpretability. Quantitative evaluation on held-out test pairs is currently in progress, with results to be presented in the full paper. XGNN's combination ofgraph scale, embedding richness, and built-in explainability positionsit as a clinically actionable framework for accelerating drug repurposing pipelines in rare disease and pandemic response settings.

AI PROCORTING CHEATING PREVENTION IN ONLINE EXAM

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Abstract:

AI Cheating Prevention in Online Exams With the rapid growth of online education, maintaining academic integrity during remote examinations has become a major challenge. The increasing availability of artificial intelligence tools and digital resources has made it easier for students to engage in unfair practices during online tests. This study focuses on the development of an AI-based cheating prevention system designed to monitor and detect suspicious activities during online examinations. The proposed system utilizes technologies such as facial recognition, eye- movement tracking, browser monitoring, and behavior analysis to identify potential cheating attempts in real time. Machine learning algorithms analyze patterns such as unusual head movements, multiple faces on screen, switching tabs, and abnormal response times to ensure exam authenticity. The system provides automated alerts and detailed reports to instructors for further verification. By integrating AI-driven proctoring techniques, the solution aims to create a secure and reliable examination environment while minimizing manual supervision. This approach improves the credibility of online assessments and helpseducational institutions uphold fairness and transparency in digital learning environments.

SOFTWARE FOR SPEECH LANGUAGE THERAPY CLINICAL SERVICES

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Abstract:

Speech-Language Therapy Clinical Services play a vital role in the assessment, treatment, and rehabilitation of individuals with speech, language, and communication disorders. Rehabilitation institutes providing these services often handle a high volume of therapy cases with a limited number of qualified supervisors and a larger number of student therapists. In many such institutes, the entire clinical workflow—including patient allocation, therapy planning, session documentation, progress reporting, supervisor review, and clinical evaluation—is still managed manually using paper records or unstructured digital files. This manual approach leads to delays in service delivery, increased administrative workload, difficulty in tracking patient progress over time, and challenges in maintaining consistency and transparency in clinical evaluation. The objective of this project is to design and develop a web-based software system that digitizes the complete speech-language therapy clinical workflow within rehabilitation institutes. The proposed system provides a centralized platform where patient cases can be systematically allocated to therapists and supervisors, therapy

plans with defined goals and activities can be documented, and therapy sessions can be recorded in a structured manner. By digitizing therapy-related documentation, the system ensures that all clinical data is stored securely and can be easily accessed for review and evaluation. A key focus of the proposed solution is to support clinical evaluation of therapy through structured digital records rather than replacing professional judgment. Supervisors can review therapy plans, session logs, and progress reports through the system and provide feedback and clinical ratings based on predefined evaluation parameters. This structured approach improves the quality and consistency of clinical evaluation while reducing reliance on subjective or incomplete records. Basic AI- assisted analysis techniques are incorporated only to support decision-making, such as identifying progress trends and summarizing session data, without performing automated diagnosis or replacing the role of speech-language pathologists. The proposed system improves coordination between therapists and supervisors, reduces manual paperwork, and enhances the efficiency and reliability of clinical services. By maintaining centralized and well-organized clinical records, the software enables better tracking of patient improvement, supports informed clinical decisions, and contributes to improved quality of care. Overall, this project provides a feasible, cost-effective, and scalable digital solution that aligns with real-world clinical practices and addresses the operational challenges faced by rehabilitation institutes in delivering speech- language therapy services.

Keywords:
Speech-Language Therapy, Clinical Services, Rehabilitation Institutes, Therapy Documentation, Clinical Evaluation, Supervisor Review, Web-Based Application, Healthcare Information System, Digital Workflow, AI-Assisted Decision Support.

Lung Cancer Classification from Chest CT Images Using Machine Learning Techniques

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Abstract:
This study presents an automated lung cancer detection system analyzing CT scans through a comparative framework of Random Forest (RF) and Convolutional Neural Network (CNN) models. Preprocessing stages—including noise reduction, intensity standardization, and lung region isolation—refine input data for robust feature extraction. The CNN architecture demonstrates superior diagnostic capability over RF in classifying Benign, Malignant, and Normal cases, leveraging its intrinsic ability to autonomously learn hierarchical spatial patterns from tumor morphology. Clinical interpretability is ensured through saliency mapping, aligning model focus with radiological markers. For practical implementation, the system is deployed via an intuitive web interface built on lightweight APIs, enabling real- time scan analysis with probabilistic outputs. This work bridges AI innovation and clinical needs, prioritizing early detection while addressing critical challenges like class imbalance and model transparency, ultimately proposing a scalable decision-support tool for integration into diagnostic workflows.

Keywords: Lung Cancer, Chest CT Images, Machine Learning, Convolutional Neural Network (CNN), Random Forest, Medical Image Classification.

TRANSPARENT AND PRIVACY-PRESERVING DATABASE OBSERVABILITY IN JAVA

ENTERPRISE APPLICATIONS THROUGH RUNTIME BYTECODE AUGMENTATION

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Abstract:
Enterprise-grade Java applications routinely offload critical business logic torelational database systems, making database interaction one of the highest-value observability targets in modern software operations. Yet achieving deep, continuous visibility into those interactions — without altering production source code or introducing vendor- specific dependencies — remains an open challenge for both operators and compliance teams. This paper introduces a non-invasive, unified observability framework for database query monitoring that operates entirely within the Java Virtual Machine (JVM) runtime environment. The framework intercepts database calls transparently at the bytecode level before they reach the underlying database driver, requiring neither modifications to application source code nor changes to driver binaries. Sensitive information embedded within intercepted queries is automatically detected and redacted by an integrated data- privacy engine prior to any log storage, safeguarding compliance with global data-protection mandates. The captured telemetry is subsequently consumed by an analytics and visualization subsystem that renders multi-dimensional insights across seven operational perspectives, encompassing performance profiling, query classification, user-level attribution, and temporal load characterization. Empirical evaluation against a representative enterprise workload confirms that the framework imposes less than 1.2% throughput degradation while delivering full-spectrum query observability and regulation-ready audit trails. The deployment model requires only a single runtime configuration parameter, rendering theframework immediately applicable to both legacy and cloud-native application landscapes.
Keywords: Runtime Bytecode Augmentation, Database Query Observability, Sensitive Data Redaction, JVM Agent Technology, JDBC Transparency, Log Analytics, Privacy Compliance, Enterprise Monitoring.

SENTIMENT ANALYSIS USING MACHINE LEARNING

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Abstract:
With the rapid growth of social media platforms and online communication, large volumes of user-generated content are produced in multiple languages every day. Understanding the sentiment expressed in this multilingual data is crucial for businesses, researchers, and organizations to analyze public opinion, customer feedback, and social trends. Multilingual sentiment analysis aims to automatically detect and classify the emotional tone of text written in different languages. However, traditional machine learning methods often struggle with language diversity, contextual meanings, and variations in grammar and vocabulary. This project proposes a Multilingual Sentiment Analysis system using Deep Learning techniques to accurately classify sentiments such as positive, negative, and neutral from text data across multiple languages. The system leverages advanced Natural Language Processing (NLP) methods combined with deep learning models such as Recurrent Neural Networks (RNN), Long Short-Term Memory (LSTM), or Transformer-based architectures to capture contextual relationships within the text. Preprocessing steps including tokenization, stop-word removal, and language normalization are applied to prepare the multilingual dataset for analysis. The

proposed system is trained using labeled datasets containing text samples from various languages such as English, Hindi, and other regional languages. Word embeddings and language representation techniques are used to convert textual information into numerical vectors that deep learning models can process effectively. The model learns semantic patterns and contextual dependencies, enabling it to predict sentiment with improved accuracy compared to traditional approaches. Performance of the model is evaluated using standard metrics such as accuracy, precision, recall, and F1-score. Experimental results demonstrate that deep learning-based multilingual models significantly enhance sentiment classification performance by understanding contextual meaning across languages. The developed system can be applied in several real-world applications including customer feedback analysis, brand monitoring, social media analytics, product review analysis, and public opinion mining. By enabling automated sentiment detection across multiple languages, the proposed approach helps organizations make informed decisions and gain valuable insights from global user-generated data.

AI-Powered Smart Document Analysis System Using LLM"

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Abstract:

An AI-Powered Smart Document Analysis System using Large Language Models (LLMs) designed to automate the processing and understanding of digital documents. The system enables users to upload documents such as PDFs, extracts textual information using document parsing techniques, and applies LLM-based analysis to generate meaningful insights. It provides features including automatic summarization, key information extraction, and question–answering from the document content. By leveraging advanced natural language processing capabilities, the system significantly reduces the time and effort required for manual document review. This approach improves document accessibility, enhances information retrieval, and supports efficient decision-making in academic, organizational, and government environments.

FOCUSGUARD - AI BASED SMART ATTENTION MONITORING SYSTEM FOR ONLINE CLASSROOMS

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Abstract:

The instant move from traditional classroom instruction to online learning has made it difficult to keep students interested and keep an eye on their attention spans. Online learning environments offer few tools for in-the-moment attention monitoring, in contrast to traditional classroom settings where teachers can watch for behavioural indicators like posture and eye contact. This study suggests

FOCUSGUARD, an AI-based smart attention monitoring system that uses computer vision and deep learning techniques to identify and assess students' levels of concentration during virtual sessions. The proposed solution uses a webcam-based visual monitoring technique to record pupils' live video frames. The system assesses whether a learner is focused or distracted by using landmark-based gaze estimates and Convolutional Neural Networks (CNNs) for facial identification and emotion categorisation. Head pose estimation is utilised to analyse orientation and focus direction, while the Haar Cascade and Dlib facial landmark algorithms are employed to detect faces and eyes.Using pre-trained datasets like FER2013, the model also incorporates emotion identification, categorising expressions into attention-related groups (e.g., focused, neutral, distracted, or drowsy). Multimodal data like gaze direction, eye openness, head angle, and emotion are used by the system to calculate an Attention Index Score in real time. Teachers receive quick notifications for student inattention and attention reports based on the results, which are presented on an interactive dashboard. This makes it possible to use adaptive teaching and proactive intervention to increase learning effectiveness. By ensuring automated, ongoing, and impartial attention monitoring, the suggested AI-driven method improves the standard of online learning. By processing facial data locally, adhering to ethical standards in AI-based educational systems, and bridging the gap between automated attention tracking and human observation, FOCUSGUARD further prioritises data protection. Keywords — Computer Vision, Convolutional Neural Networks (CNNs), Emotion-aware AI Systems and Multimodal AI Systems, Online learning analytics, facial expression recognition, real-time attention tracking.

Performance Evaluation of a Control-Surface-Less Aircraft Using Advanced Thrust Vector Control

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Abstract:
The control of conventional aircraft is achieved using ailerons, elevators and rudder. This adds to the structural complexity, weight and maintenance. The purpose of this paper is to investigate a new class of aircraft that inherently does not rely on control surfaces. The main control method for this aircraft will be thrust vector control. This paper contains detailed computational fluid dynamics analysis of a rigid delta trapezoidal wing. The Reynolds- averaged Navier-Stokes equations employing k-ω SST turbulence modeling have been employed in this analysis. In this respective analysis, tests were conducted across 10 angles of attack ranging from 0° – 45°. In this analysis, the wing was designed with a NACA 2406 airfoil sectional, with a sweep angle of 65° and a taper ratio of 0.15 (sharp). This airfoil section is particularly well suited to exploit vortex-induced lift. This analysis shown has been able to create stable lift over the range of angles of attack.For this analysis, the wing was able to maintain stable lift across the entire range of angles of attack. This is maximum at Angle of Attack of 40°. Also an overall range of angles of attack, the aerodynamic phenomena has been quite smooth in this analysis. A similar analysis is broken into three regions here: linear attached flow from 0° to 11°, vortex transition from 15° to 23°, and vortex-dominated flows over the 23° zone. In this analysis, the control surfaces were removed, rendering the aircraft easy to manufacture and easier to fly. This allows for easier aircraft control than with standard conventional control surfaces.
Keywords: Thrust Vector Control, Delta Wing Aerodynamics, Vortex Lift, Control Surface Less Aircraft, CFD Analysis, Unmanned Aerial Vehicles, k-ω SST Turbulence Model.

AI-Based Smart Energy Management System for Industrial Automation

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BANNARI AMMAN INSTITUTE OF TECHNOLOGY.

Abstract:

Industrial energy consumption has grown significantly with the rise of automation and smart manufacturing under the Industry 5.0 framework. Existing energy management approaches are largely rule-based and operate reactively, which leads to inefficiencies in load scheduling and increased operational costs. This paper proposes an AI-based Smart Energy Management System (AI-SEMS) that uses machine learning to predict future energy demand in industrial settings and supports proactive decision-making for load control and energy optimization. The system integrates three prediction models—Linear Regression (LR), Random Forest (RF), and a Multilayer Perceptron Neural Network (MLP-NN)—within a unified experimental framework. An inverse-MAPE weighted ensemble of RF and MLP-NN achieves a Mean Absolute Percentage Error (MAPE) of 11.3%, which represents a 20.2% reduction compared to the conventional ARIMA baseline. The system is designed to interface with SCADA and EMS platforms via standard industrial protocols and supports real-time load scheduling, demand response, and renewable energy integration.

Keywords — smart energy management; machine learning; industrial automation; Industry 5.0; energy consumption prediction.

WEB-BASED IT AND OT VULNERABILITY MANAGEMENT SYSTEM

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BANNARI AMMAN INSTITUE OF TECHNOLOGY

Abstract:

The project "Web-Based IT and OT Vulnerability Detection and Reporting System" focuses on developing an intelligent system that automatically detects, collects, and reports Critical and High severity vulnerabilities published by Original Equipment Manufacturers (OEMs) and public cybersecurity platforms. In modern digital environments, organizations rely heavily on Information Technology (IT) and Operational Technology (OT) systems to support critical infrastructure and business operations. However, these systems are continuously exposed to security vulnerabilities that can be exploited by cyber attackers. OEMs frequently publish security advisories and vulnerability disclosures, but manually monitoring these sources is time-consuming, inefficient, and may lead to missed security updates. To address this challenge, the proposed system implements an automated web-scraping framework capable of collecting vulnerability information from multiple OEM security portals and publicly available cybersecurity platforms. The system continuously scans and extracts relevant vulnerability data such as vulnerability identifiers, severity levels, affected products, vulnerability descriptions, and publication details. In addition to data collection and storage, the system generates structured vulnerability reports that present summarized information about high-risk vulnerabilities affecting specific equipment or systems. These reports help security analysts and administrators quickly understand the nature of potential threats and take appropriate mitigation measures. By providing organized and up-to-date vulnerability intelligence, the system supports proactive cybersecurity management and enhances overall threat awareness. Overall, the Automated Web-Based Vulnerability Detection and Reporting System for IT and OT Equipment provides an

efficient and scalable approach to vulnerability monitoring. Through automation, structured data storage, and report generation, the system reduces manual workload while improving the speed, accuracy, and reliability of vulnerability tracking. This contributes to better cybersecurity preparedness and helps organizations protect their IT and OT infrastructure from emerging cyber threats.

Keywords: Vulnerability Detection, Web Scraping, Cybersecurity Monitoring, IT and OT Security, OEM Security Advisories, Vulnerability Reporting System, Threat Intelligence,Automated Security Monitoring.

MACHINE LEARNING MODEL FOR PREDICTING DIMENSIONAL STABILITY IN TEXTILE DYEING AND FINISHING PROCESSES

Dharshini C | **Muhammed Zaid M**

Bannari Amman Institute of Technology

Abstract:

Among the textile dyeing and finishing processes, dimensional stability is considered one of the main quality variables. Existing methods for the control of dimensional stability are highly experience-dependent and empirical. The paper explains how the use of machine learning will be able to predict the dimensional stability of the fabric before the finishing process.The type of fabric, yarn count, weave, and density represent the fabric properties; process variables include the dyeing and finishing processes, temperature, pH values, time, tension, and stretch. Finally, metadata is included. The output consists of a dimensional change percentage under standard conditions. A comparative performance analysis of various machine learning classifiers includes XGBoost, LightGBM, CatBoost, Random Forest, and linear regression. Cross-validation and widely used evaluation criteria will be applied: MAE, RMSE, R2. In this respect, the paper will make sure machine learning is interpretable by using SHAP values and permutation feature importance. The approach will define which factors are significant in changing the dimensional stability of fabrics. The findings indicate the ability to use machine learning to accurately forecast shrink and growth, thereby minimizing guesswork, defects, and inconsistencies within the process. It formulates the best possible implementation plan, starting from the testing phase to the eventual incorporation of the process within the overall quality control system. Therefore, the method will enable predictive process control, promote sustainable manufacturing, and optimize process efficiencies in the textile processing industry.

Keywords : Dimensional stability, Machine learning, Predictive modeling, Process optimization, Sustainability, Textile finishing.

LexGuard AI – A Transparent Legal Case Eligibility Checker and Document Readiness Assessment

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Abstract:

Access to legal services remains a major challenge for many individuals due to complex legal

procedures, extensive documentation requirements, and high consultation costs. Many people are uncertain whether their case is eligible for filing or whether they possess all the necessary documents required by the court. As a result, several legal cases are delayed or rejected due to incomplete documentation, incorrect case classification, or missed limitation periods. Currently, there is no simple system that allows individuals to verify their case eligibility and document readiness before approaching a lawyer or court. This project aims to address this issue by developing LexGuard AI, a transparent and intelligent legal decision support system that assists users in evaluating their legal case before filing. The proposed system analyzes user-submitted case descriptions and uploaded documents to determine whether the case satisfies legal conditions and whether all required documents are available. The system uses Natural Language Processing (NLP) to classify case types from user input and applies predefined legal rules to check eligibility and limitation periods. In addition, the uploaded documents are evaluated to measure completeness, and the system generates a document readiness score indicating whether the case is prepared for filing. To improve transparency and trust, Explainable Artificial Intelligence (XAI) is integrated to provide clear explanations for eligibility results and highlight missing or insufficient documents. The framework also incorporates technologies such as Optical Character Recognition (OCR) for extracting text from legal documents, FAISS for efficient legal information retrieval, and PostgreSQL for secure data storage and management. The final system provides a structured report summarizing case eligibility status, document readiness score, and explanation of results. By offering an AI-driven pre-filing evaluation process, LexGuard AI helps reduce unnecessary legal consultations, minimizes case rejection caused by documentation errors, and improves access to legal guidance for users.

Keywords: Artificial Intelligence, Legal Case Eligibility, Document Readiness Assessment, Natural Language Processing, Explainable AI, OCR.

An IoT-Enabled Real-Time Air Quality Monitoring System with Mobile Alert Mechanism

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Vels institute of science technology and advanced studies (VISTAS)

Abstract:

In today's world, air pollution poses a significant threat both to the environment (ecosystem) and to human health. The increase in greenhouse gases has been primarily caused by rapid industrialization, increased urbanization and ever-increasing vehicle emissions. Continued monitoring of air quality is vital to ensuring public health and raising environmental awareness at the same time. This project aims to develop a Real-Time Air Quality Monitoring and Notification System using Data Analytics in conjunction with an Android Application. The Real-Time Air Quality Monitoring and Notification System will use an MQ135 gas sensor to determine concentrations of Carbon Dioxide , Ammonia and Smoke , etc. The MQ135 sensor will connect to a Wi-Fi-enabled microcontroller. This microcontroller collects air quality data periodically as well as transmits this historical data to a Firebase Cloud database using Wi-Fi connectivity. The collected data will then be analyzed to determine and classify it into an air quality level; "Good", "Moderate", and "Dangerous". An Android mobile application will provide real-time air pollution data and alert individuals that the air pollution level is above predefined limits by providing push notifications, emails or SMS messages. This Real-Time Air Quality Monitoring and Notification System is inexpensive, lightweight, and portable; it is ideal for use in smart cities, industries or residential

communities for improving environmental monitoring and increasing public health awareness.

Keywords: Air Quality Monitoring, MQ-135 Sensor, ESP8266, Android Application, Environmental Monitoring.

Autonomous Microgrid Management System with AI-Powered Load and Fault Prediction

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Abstract:

The increasing demand for reliable and efficient energy management has led to the development of intelligent microgrid systems. This project presents an Autonomous Microgrid Management System with AI-Powered Load and Fault Prediction designed to enhance energy monitoring, load control, and system reliability. The system integrates voltage and current sensors with a microcontroller-based data acquisition unit to continuously measure electrical parameters such as voltage, current, and power. These parameters are transmitted to a cloud platform using a Wi-Fi enabled module and stored in a Firebase Realtime Database for remote monitoring and analysis. A web-based dashboard provides real-time visualization of system parameters, graphical data analysis, and load control functionality. An Artificial Intelligence module analyzes historical energy data to predict future load demand and assist in intelligent load management. Based on the predicted load conditions, the system can automatically control connected loads to improve energy efficiency and prevent overload conditions. In addition, the system incorporates a fault detection mechanism that identifies abnormal conditions such as overcurrent and voltage fluctuations. The proposed system provides a scalable and cost-effective solution for smart energy management and contributes to the development of intelligent and sustainable microgrid infrastructures.

Keywords— Microgrid, Internet of Things (IoT), Energy Monitoring, Load Prediction, Fault Detection, Smart Grid, Firebase, Artificial Intelligence.

Document signing using ECDSA digital signatures

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Abstract:

With the rise of digital communication and cloud storage, safeguarding private documents now occupies centre stage in data protection overall. This project introduces a Secure Document Management System that assures confidentiality, integrity, and authenticity for each digital file. This software application has been developed employing the Flask web framework allowing users to register in a secure manner, authenticate their registration, upload and manage their documents through a web interface in a secure way. All files uploaded to the system are secured through AES-256 encryption to ensure confidentiality and ECDSA digital signatures will be created by the system so that users can detect if any unauthorized modification of the document has taken place. An SQLite

database is used to store user credentials and document details, and password hashing and session handling methods are employed to enhance authentication security. The proposed system will provide a secure method for the storage and management of sensitive digital files that combines the technologies of encryption and digital signatures via a web-based application.
Keywords: Secure Document Management, AES Encryption, Elliptic Curve Digital Signature Algorithm (ECDSA), Digital Signatures.

Vision-Based Traffic Sign Recognition Using YOLO for Autonomous Driving Applications

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Abstract:
Traffic Sign Recognition (TSR) is a crucial perception component in autonomous driving systems. The open challenges are, reliable detection and classification of traffic signs across diverse real-world conditions, including low illumination, motion blur, partial occlusion, and adverse weather. YOLO-OK+, an enhanced vision-based traffic sign recognition framework is presented in this paper, that augments the YOLOv8s architecture with two novel algorithmic contributions: (1) K-Means++ anchor box generation from the target dataset to replace generic COCO-derived anchors, and (2) OPTICS density-based clustering as a replacement for standard Non-Maximum Suppression (NMS) in post- processing. Contrast-Limited Adaptive Histogram Equalisation (CLAHE), unsharp masking for motion deblurring, and Bayesian hyperparameter optimization via Optuna are incorporated in the three-stage adaptive preprocessing pipeline as additional improvements. Comprehensive evaluation on the Tsinghua-Tencent 100K (TT100K) benchmark demonstrated that YOLO-OK+ achieves a mean Average Precision (mAP@0.5) of 91.3%. This represents a 2.1% gain over the YOLO-SDW baseline and 6.1% over the standard YOLOv8s, while maintaining real-time inference at 55 FPS on a GPU. The proposed system is suitable for safety-critical autonomous driving deployment as it is validated under fog simulation, night conditions, and dense sign scenarios.
Keywords: traffic sign recognition, autonomous driving, YOLOV8, OPTICS clustering, K-Means++ anchors, object detection, convolutional neural networks, TT100K.

AI-Powered Driver Safety System for Fatigue and Distraction Monitoring

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Abstract

Road safety remains a significant global challenge, with a substantial proportion of traffic accidents caused by driver fatigue and distraction. Long driving hours without adequate rest, combined with frequent mobile phone use, reduce driver alertness and response time, leading to dangerous road conditions. This project presents the development of a driver monitoring system designed to detect early indicators of drowsiness and distraction, enabling timely intervention to prevent accidents. Previous approaches have primarily focused on eyeblink rate or head-pose estimation using traditional image-processing techniques. However, these methods often struggle under poor lighting or partial face visibility. To address these issues, the proposed system integrates deep learning models such as Convolutional Neural Networks (CNNs) for robust facial feature

extraction and OpenCV- based image processing for continuous video analysis. The system is implemented using Python, TensorFlow, and OpenCV. A webcam or in-vehicle camera continuously captures the driver's face in real time, and computer vision algorithms detect key facial landmarks including eyes, mouth, and head position. The model identifies signs of fatigue and distraction by analyzing prolonged eye closure, yawning frequency, and mobile phone usage. When such behaviors are detected, the system triggers audio or visual alerts to refocus the driver's attention. Experimental evaluation demonstrates reliable detection of drowsiness, yawning, and distraction across varying lighting conditions and driver positions. The unified, real-time architecture improves accuracy and responsiveness, making it suitable for integration into modern vehicles as part of intelligent driver-assistance systems. Overall, the system offers a practical and cost-effective solution to enhance road safety and reduce fatigue-related accidents.

Keywords: Driver Monitoring System, Drowsiness Detection, Distraction Detection, Yawning Detection, Mobile Phone Usage Detection, Real-Time Processing, Road Safety, Intelligent Transportation System, Fatigue Monitoring.

AI POWERED FIRE FIGHTING DRONE FOR FIRE CONTROL

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Abstract

Fire accidents in industries, cities, and wooded areas remain dangerous to human lives, infrastructure and environment. Besides making the Fire control operations very tough, there is intense physical risk to the rescue team brought about by these conditions. This is leading to an increasing need of highly sophisticated solutions that can help or partially mechanize fire detection and suppression, which helps reducing the risk presented to the human responders as well as improving the response rate and operational efficiency. Unmanned Aerial Vehicles (UAV) have also become a promising form of emergency response and disaster management activity. In comparison with other types of UAVs, hexacopters have unique advantages such as the ability to carry higher payloads, because of increased flight stability; they are also able to be redundant in case of motor failure, which is not the case on the quadcopter. The study introduces the idea, design, and support of a hexacopter autonomous system, powered by an Artificial Intelligence (AI) and able to identify fires and put them out in real time. The suggested system incorporates onboard AI to detect fire utilizing image-processing tools and thermal patterns. A vision-based detection unit will receive live data of the cameras and it tries to differentiate and mark a possible source of fire by examining the variation in luminance, and movement patterns used by the fire activity. After it is detected, GPS-assisted navigation technology is used by the system to find the target location and approach the fire source on its own. This ability significantly saves the time of the initial intervention and allows acting in the areas where the work cannot be done or is unsafe by human firefighters. The hexacopter platform will utilize a deployment mechanism which is operated by servo and is designed to release fire-extinguishing spheres in the positions directly above the fire locus. These small light weight extinguisher balls automatically eject extinguishing powder when they are exposed to heat or collision. Their use during aerial firefighting gives it a variety of advantages such as ease of fire, and low level of mechanical sophistication. Activation of this mechanism together with an AI-controlled UAV will help to achieve accurate and localized fire suppression at the initial phases of the fire

formation, when it is most convenient to contain the fire. The entire system architecture consists of some subsystems including the flight control system, onboard processing unit, sensor integration system, and payload deployment system. Flight controller provides the development of a stable hexacopter during the autonomous missions in terms of navigation and attitude control. Sensors - GPS, environmental sensors, etc. The onboard central processing unit interprets visual signals and compares the AI algorithm that detects a fire, and makes a decision. When a fire is verified, this system automatically switches on the suppression system, and then not only does not lose flight stability. To determine the efficiency of the proposed system, a large amount of testing was done in an experimental manner. Some of the most crucial parameters were studied in the experiments, including flight stability, the thrust-to-weight ratio, payload capacity, energy consumption, and accuracy of suppression. Findings demonstrate that the hexacopter platform does not alter flight characteristics under the conditions that it is loaded with the fire-fighting payload. The thrust-weight ratio was sufficient to give an integrated set of components, which can be taken as sensors, processing hardware, and extinguishing spheres. In sum, the system that has created artificial intelligence and the UAV technology in intelligent firefighting. The suggested platform offers a low-cost, scalable solution that has the potential to drive in supporting early fire detection and suppression, therefore, reducing the damage, human lives and thereby it reduces the operational risks faced by firefighters. Further research can be aimed at improving performance of detection models by the application of multiple deep-learning models, improving flight range by means of efficient power controls, and using several drones in coordinated firefighting by large fire.

DESIGN & EXPERIMENTAL EVALUATION OF THERMAL PROTECTION SYSTEM PANEL

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Abstract

Thermal protection system (TPS) are essential for the spacecraft returning to earth. In a short period of time the capsule exposed to extreme temperature due to aerodynamic heating. The development of low cost composite TPS configuration capable of providing effective thermal insulation remains an important research objective. In the present study, a multi-layer composite thermal protection system panel is designed and evaluated through transient thermal analysis and experimental flame testing. The proposed design consists of carbon-phenolic outer layer for ablative resistance, a phenolic-cork middle insulation layer, and a metallic aluminium backing plate for structural support. The FEM analysis is done to examine temperature distribution through-thickness under an controlled heat flux condition representative of laboratory-scale re- entry simulation. The heat flux behaviour and temperature evolution were analyzed to assess insulation performance and thermal gradient development across layers. Experimental validation using an oxy-acetlene flame setup is conducted to measure back-face temperature and thickness reduction. The results demonstrates that the effectiveness of the multi-layer configuration in generating strong thermal gradients and limited amount of heat penetration of the rear surface.

Key Words: Thermal protection, Aerodynamic heating, Thermal insulation, Carbon-phenolic, Phenolic-Cork, Aluminum, Heat flux, Thermal gradient, oxy-acetlene flame.

A Compact Common-Ground Transformer-less Inverter with Integrated Voltage Boosting for Photovoltaic Applications

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Abstract:
Transformer-less inverters with common-ground (CG) configuration have emerged as an attractive solution for photovoltaic (PV) applications due to their capability to eliminate ground leakage current while reducing system size, cost, and power losses. These advantages make them highly suitable for modern grid-connected PV systems. However, conventional PV inverter systems often rely on an additional DC–DC boost converter to step up the relatively low voltage generated by PV arrays. The inclusion of this extra conversion stage increases circuit complexity, component count, and switching losses, thereby reducing the overall system efficiency. To address these challenges, this paper proposes a novel switched-capacitor (SC)-based common-ground transformer-less inverter that achieves inherent voltage boosting without requiring a separate DC–DC converter. The proposed topology integrates switched-capacitor techniques within the CG framework, enabling single-stage power conversion with enhanced performance. The switched capacitors are configured to operate in both series and parallel modes at different intervals of the fundamental cycle. This dynamic operation not only provides the required voltage gain but also ensures natural voltage balancing across the capacitors, thereby eliminating the need for additional sensing or balancing circuits. A simple and efficient control strategy based on logic gate-driven pulse-width modulation (PWM) is developed to govern the switching operations. This control approach reduces implementation complexity and enhances the practicality of the proposed inverter for real-time applications. The performance of the proposed inverter is evaluated through a comparative analysis with recently developed SC-based inverter topologies. The results demonstrate significant improvements in terms of reduced component count, enhanced voltage boosting capability, and complete elimination of ground leakage current. These features contribute to improved efficiency, reliability, and cost-effectiveness of the system. To validate the proposed design, a hardware prototype is developed and tested under both steady-state and transient operating conditions. The experimental results confirm stable operation, effective voltage boosting, and reliable performance under varying load and input conditions. Overall, the proposed inverter offers a compact, efficient, and practical solution for PV applications, making it a promising alternative to conventional multi-stage inverter systems.

Adaptive Neutral-Point Shift Control for Enhanced Fault Resilience in Grid-Connected Cascaded Multilevel Inverters

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Abstract

Grid-connected three-phase cascaded multilevel inverter (CMI) systems are widely used in medium- and high-power applications due to their modularity and superior output voltage quality. However, under asymmetric operating conditions—such as faults in one phase—the performance of these systems deteriorates significantly, leading to unbalanced voltages and distorted grid currents. Conventional fault-tolerant approaches typically depend on hardware redundancy or zero-sequence voltage injection techniques. While effective, these methods often introduce additional system complexity, increase implementation cost, or require precise voltage sensing and control. This paper presents a novel control strategy based on adaptive neutral-point shifting to enhance the fault tolerance and operational resilience of grid-connected CMI systems. In the proposed approach, the inverter's output neutral point is dynamically adjusted during fault conditions, allowing the voltage deficit in the affected phase to be redistributed among the healthy phases. This coordinated voltage sharing ensures that the line-to-line voltages remain balanced, thereby maintaining high-quality grid currents even under asymmetric faults. In addition to the neutral-shift mechanism, an improved inner-loop current control scheme is developed using an internal modulation-based feedforward approach. This control strategy enhances steady-state current tracking performance while reducing dependence on real-time measurements of the point of common coupling (PCC) or grid voltages. As a result, the proposed method simplifies the sensing requirements and improves system robustness against measurement uncertainties. A detailed theoretical framework is established to model the proposed control scheme, followed by a comprehensive closed-loop analysis to evaluate system stability and dynamic response. The effectiveness of the proposed strategy is validated through both simulation and experimental studies under various fault scenarios. The results demonstrate that the method successfully maintains balanced grid currents, minimizes distortion, and ensures reliable inverter operation without the need for additional hardware redundancy. Overall, the proposed adaptive neutral-point shift control provides a cost-effective, simple, and efficient solution for improving the resilience of CMI-based grid-connected systems, making it highly suitable for modern power conversion applications requiring high reliability and fault tolerance.

Keywords: *Voltage control, Fault tolerant systems, Multilevel inverters, Grid connected*

Automated Train Stopping System at Station Foul Point with Sensor-Based Management

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Abstract

This paper will explain about the modern railway system and the problems faced at the station due to the foul point in train stopping and the solution to the solution to that problem. Modern railway systems require advanced automation to ensure the safety and efficiency in train operations. So one of the most important point is safety point is the foul point, beyond which train may cause obstruct to other trains and at the serious conditions it may collide with the other trains. The system uses a ultrasonic sensors, IR sensors, arduing mega and microcontrollers to detect the motion and measure

the distance, level, positions are used to detect the trains position and automatically initiate stopping at the respective foul point. The system ensures safety, reduces reliance on manual braking, and can be integrated with the existing signalling infrastructure. The solution is low cost, scalable respectively.

Keywords: Railway safety, Foul point detection, Automatic train stopping, Ultrasonic sensors, Infrared (IR) sensors, Arduino Mega, Microcontroller-based control, Distance measurement, Collision prevention, Intelligent transportation systems.

Design and Implementation of Reduced Switch Five-Level Inverter

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Abstract

This paper presents the design and implementation of a reduced-switch five-level inverter using a hybrid topology consisting of a diode bridge and a full H-bridge inverter. The proposed system utilizes only five switches (S1–S5), thereby reducing switching losses, cost, and circuit complexity compared to conventional multilevel inverters. The DC-link voltage is divided into two levels using capacitors to generate five distinct output voltage levels: +Vdc, +Vdc/2, 0, −Vdc/2, and −Vdc. An auxiliary switch along with a diode network is employed to produce intermediate voltage levels, while the H-bridge ensures polarity reversal of the output. The inverter produces a stepped waveform that closely approximates a sinusoidal output, resulting in reduced Total Harmonic Distortion (THD). The proposed system is prototype is made and validated using MATLAB/Simulink, and the simulation results confirm effective multilevel output generation with improved waveform quality. A hardware prototype is developed using MOSFET switches driven by TLP250 gate drivers and controlled by a PIC30F2010 microcontroller to verify real-time performance. Experimental results demonstrate reduced switching losses, improved efficiency, and reliable operation under different load conditions. The proposed inverter is compact, cost-effective, and suitable for renewable energy and power conversion applications.

Keywords— Multilevel Inverter, Reduced Switch Inverter, PWM, MATLAB/Simulink, TLP250, PIC30F2010, THD.

Interest-Free Peer-to-Peer Lending

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Abstract

Peer-to-peer (P2P) lending platforms allow borrowers and lenders to interact directly through digital systems, improving financial accessibility beyond traditional banking models. However, many existing platforms mainly rely on interest-based repayment structures and predictive credit scoring techniques. While such approaches help estimate financial risk, they do not always enforce strict structural controls within the platform workflow. In this work, a prototype interest-free P2P lending platform is developed to demonstrate preventive control mechanisms within the lending system. The platform includes several safeguards such as a fixed loan exposure cap, borrower wallet balance locking, administrative verification of loan requests, and automated installment monitoring. The system was implemented as a web-based application using PHP and MySQL. Borrowers can submit loan requests through the platform after maintaining the required wallet balance. Lenders can review approved requests and fund loans using their wallet balance. Repayment is handled through scheduled installments where the principal amount is divided equally across the selected tenure without interest charges. To improve transparency and data integrity, financial transactions are recorded using a SHA

256 hash- linked ledger structure. Each transaction stores a cryptographic hash referencing the previous record, allowing the system to detect any modification in transaction history. The prototype was evaluated through functional testing scenarios including loan validation, repayment monitoring, and ledger integrity verification. The results show that the system successfully enforces borrowing limits, manages repayment conditions, and identifies ledger inconsistencies. These findings demonstrate how architectural control mechanisms can improve transparency and discipline in digital lending platforms.

Development of Optically Transparent Planar Antenna for Millimetre Wave Based WBAN Application

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Abstract

The rapid development of wearable technology and body-centric communication systems has increased the demand for compact, lightweight, and efficient antennas that can seamlessly integrate with the human body. Wireless Body Area Networks (WBAN) play a vital role in modern healthcare monitoring, fitness tracking, and other wearable applications. In this project, a transparent planar antenna is designed and developed specifically for millimetre-wave WBAN applications. The proposed antenna aims to provide efficient radiation characteristics and adequate bandwidth while maintaining a compact size and lightweight structure suitable for wearable devices.

One of the key objectives of this design is to reduce the visual impact of the antenna when integrated into wearable platforms such as smart clothing,s medical sensors, and body-mounted communication devices. To achieve this, transparent conductive materials are utilized in the antenna structure. These materials allow electromagnetic signal transmission while maintaining optical transparency, enabling the antenna to remain almost invisible when placed on surfaces like glass, plastic, or flexible substrates. This feature makes the antenna highly suitable for applications where aesthetics and user comfort are important considerations.

The antenna is designed to operate in the millimetre-wave frequency band, which offers advantages such as high data rates, low latency, and efficient spectrum utilization. These characteristics are essential for WBAN systems that require reliable and high-speed data communication between body-worn devices and external monitoring systems. The planar structure of the antenna further simplifies fabrication and integration into compact electronic devices.

The proposed design focuses on optimizing key performance parameters such as return loss, radiation efficiency, bandwidth, and gain while ensuring that the transparency of the antenna does not significantly degrade its electromagnetic performance. Advanced design techniques and suitable substrate materials are considered to maintain a balance between transparency and antenna efficiency. Simulation and analysis are performed to evaluate the antenna's performance in terms of radiation pattern, impedance matching, and operational bandwidth.

Overall, the transparent planar antenna developed in this project demonstrates a promising solution for next-generation wearable communication systems. Its lightweight structure, compact design, and optical transparency make it an ideal candidate for integration into modern WBAN devices operating at millimetre-wave frequencies. This work contributes to the advancement of unobtrusive and efficient antennas for wearable and body-centric communication technologies.

Personalizing Smart Crop Choice for Efficient Farming Using Machine Learning

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Abstract

Agriculture today faces several difficulties such as changing climate patterns, incorrect crop selection, poor use of resources, and low production levels. Most farmers still depend on traditional knowledge and trial-and-error methods, which often result in reduced yield and economic loss. To address these problems, this project presents Smart Agriculture – an AI-based Crop Recommendation and Yield Prediction System, a web enabled intelligent platform designed to support scientific farming decisions.

The proposed system uses historical agricultural data such as soil properties, nutrient levels (N, P, K), temperature, humidity, rainfall, pH value, seasonal factors, and geographical location to recommend suitable crops and estimate expected yield. Supervised machine learning algorithms are applied for crop classification and yield prediction. In addition, the system provides calculations for fertilizer, seed, and water requirements, along with crop rotation suggestions to encourage sustainable farming practices.

The application is developed using Python Flask and integrates trained machine learning models through a user-friendly web interface. Offline storage with server synchronization is included to ensure accessibility in rural regions with limited internet connectivity. This system offers a practical and efficient agricultural advisory solution that improves productivity, supports resource optimization, and connects traditional farming methods with intelligent digital technology.

Keywords—Smart Agriculture, Machine Learning, Crop Recommendation, Yield Prediction, Web Application, Precision Farming, Resource Management, Flask, Supervised Learning.

Design and Development of a Machine Learning–Based Framework for Crime detection and prediction Analysis Using Large-Scale Data.

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Abstract

Urban safety and crime prevention remain ongoing concerns in today's cities. This is especially true for large urban environments such as New York City, where there is a high population density. The ability to accurately predict trends in crime is essential for law enforcement officials to strategically allocate resources, prevent incidents, and improve the safety of the community. This research demonstrates a machine learning-based system that uses historical (past) data along with temporal patterns and advanced feature engineering techniques to project the number of crimes that will occur on a daily basis in a given area. This predictive model utilizes four different algorithms — LSTM, CatBoost, LightGBM and XGBoost — combined into a single weighted ensemble in order to achieve the most accurate prediction possible. The systems utilize cyclical temporal encodings (i.e., an encoding of the cycle of day/night, month/year), lagged values of the variable (e.g., number of crime incidents from previous days), rolling averages/statistics (i.e., averages/statistics based on previous values), and seasonal trends (i.e., trends associated with each new season), all designed to model the complexity of criminal behavior. The application provides high-risk time periods, displays historical trends on interactive dashboards, and provides insights for each borough regarding the time of year, day of week, and time of day in order to identify the high-risk areas and times of the week. The application will provide real-time access to both forecasts and aggregated crime forecasts via a

web-based interface built using Streamlit. Additionally, there is a fallback mechanism in place should there be a failure to load a model so that the application can maintain continuous operations. The findings highlight the significant predictive capability of this application and document the high-risk periods and locations in order to inform law enforcement agencies and city agencies regarding proactive urban safety management through predictive analytics and user friendly access.

Keywords: Crime Analysis, Crime Prediction, Machine Learning, Data Mining, Predictive Analytics, Classification Algorithms, Time-Series Forecasting, Crime Hotspot Detection, Data Visualization, Public Safety

Evaluation of Mechanical Properties of Aluminium-7075/B4C/Basalt fiber hybrid metal matrix composite prepared by stir casting

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Abstract

Because of its high rigidity and low density, Aluminium is a noteworthy material among the many others. Aluminum based composite materials play an important role in various sectors especially in aeronautical and automotive sectors because of their unique characteristics. In the present work prepared hybrid metal matrix composite (HMMC) with Al 7075 as matrix material and B4C and Basalt fiber as reinforcements. HMMC was prepared by using stir casting technique with varied weight fractions such as 0%, 1.5%, 4.5%, 6.5%, 8.5% and 10.5%. With the addition of B4C and Basalt fiber properties such as tensile strength and hardness are improved. The 8.5% reinforcement combination (i.e. 6% B4C and 2.5% Bassalt fiber) exhibited better tensile strength, and hardness.

Keywords: Tensile strength, hybrid metal matrix composite, Hardness, stir casting.

Friction Stir Welding of AA2014-AA8011: Multi-objective Optimisation of Process Parameters Using TOPSIS Approach

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Abstract

In this study, multi objective optimization for Friction stir welding (FSW) of dissimilar AA2014-AA8011 has been presented to provide optimum tensile strength, hardness and Impact Strength. The study takes into account the tool rotational speed, feed, and tilt angle as input parameters. Experiments are designed based on Taguchi L9 orthogonal array. Measurements of the welded joints' tensile strength, hardness, and impact strength are used to examine the impact of FSW utilising these welding parameters. The main effects plot and interaction plot were used to discuss the parametric influence on responses. Additionally, Technique for order of preference by similarity to ideal solution (TOPSIS) was used to carry out multi-objective optimization. The tilt angle was shown to be the most

important factor influencing the responses, followed by the tool rotational speed and feed according to the results. The obtained optimum combinations of parameters are i.e. tool rotational speed 710 rpm, feed 40 mm/rev, and tilt angle 1°.

Keywords: Tensile strength, hardness, FSW, orthogonal array, multi response optimization.

AI-Powered Smart Document Analysis System Using LLM

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Abstract

The AI-Powered Smart Document Analysis System using Large Language Models (LLMs) is designed to automate the extraction, interpretation, and analysis of information from unstructured and semi structured documents such as PDFs, scanned images, and digital forms. Traditional document processing methods are time-consuming, errorprone, and require significant manual effort. This system leverages advanced Natural Language Processing (NLP) techniques and state-of the-art LLMs like GPT-4 and BERT to improve efficiency and accuracy in document handling.

The proposed system integrates Optical Character Recognition (OCR) tools such as Tesseract OCR to convert scanned documents and images into machine-readable text. The extracted text is then pre-processed and analysed using LLMs to identify key entities such as names, dates, identification numbers, and financial details. Additionally, the system performs document classification, summarization, and anomaly detection, enabling intelligent decision-making.

15-Minute Smart Meter Electricity Consumption and Billing Analysis

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Abstract

Deploying smart meters in modern electricity systems has led to generating large amounts of high-frequency energy consumption data. Traditional data processing methods cannot efficiently store and analyze such massive datasets. This research presents a big data analytics framework for examining smart meter electricity consumption and estimating billing using short-interval data. Smart meter datasets from two cities for the years 2019, 2020, and 2021 were processed using a distributed big data system. The Hadoop Distributed File System (HDFS) provided scalable storage, Hive was used for structured data warehousing, and Apache Spark handled large-scale data processing and aggregation. Electricity readings were aggregated into 15-minute intervals, which is a standard time frame for electricity load analysis. We performed analytical operations like hourly consumption analysis, demand pattern identification, and abnormal meter detection. The processed data was then visualized using Power BI dashboards, where electricity consumption and billing estimates were generated for every 15-minute interval. The dashboards allow users to monitor short-interval electricity usage, calculate estimated electricity bills based on 15-minute consumption, and identify peak usage periods. Additional dashboards provide monthly billing summaries and demand insights for electricity departments to analyze peak load behaviour. The results demonstrate that integrating big data technologies with 15-minute smart meter analytics improves electricity monitoring, billing transparency, and demand analysis for more efficient energy management.

Keywords: Smart Meter Data Analytics, 15-Minute Electricity Consumption Monitoring, Big Data Analytics, Hadoop, Apache Spark, Electricity Billing Estimation.

AI-Enabled B2B Construction Project Management System

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Abstract:

The construction industry increasingly demands efficient project coordination, accurate requirement analysis, and timely decision-making; however, most existing project management systems rely heavily on manual processes and human expertise. These limitations often result in delays, communication gaps, and reduced operational efficiency. This project proposes an AI-Enabled B2B Construction Project Management System aimed at supporting civil engineers and architects in managing construction projects and client interactions in a more intelligent and automated manner. The proposed system integrates a Large Language Model as an AI-powered professional assistant to interpret client requirements, assist in decision-making.The platform provides functionalities such as client management, AI-based requirement assistance, project planning support, cost and material guidance, and automated reporting within a unified web-based architecture. Modern frontend and backend technologies are employed to ensure scalability, reliability, and seamless interaction between system components. By introducing artificial intelligence into construction project management, the system reduces dependency on manual analysis, minimizes human errors, and enhances productivity and client satisfaction. The proposed approach demonstrates a novel application of AI in B2B construction environments, offering improved efficiency, better resource utilization, and intelligent decision support for real-world construction projects.

Keywords : Large Language Model, Project Management, Requirement Assistance.

Enhanced Drug–Drug Interaction Prediction Using Transformer-Based Deep Learning Models

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Abstract:

Drug–drug interactions (DDIs) occur when two medications interact with each other and alter their expected effects in the human body. Such interactions may lead to reduced drug effectiveness, adverse side effects, or serious health risks. Detecting and understanding these interactions is essential for ensuring patient safety and supporting healthcare professionals in clinical decision-making. Traditional drug interaction checking systems are mainly database-driven and often provide limited explanations about the cause and impact of interactions. This paper proposes a drug interaction prediction and explanation system using deep learning and biomedical natural language processing techniques. The proposed system utilizes BioBERT, a domain-specific language model trained on biomedical text, to analyze drug pairs and predict the type of interaction between them. To enhance interpretability, the system integrates a drug interaction knowledge base that provides clear

explanations of the predicted interactions. When a user enters two drug names, the system predicts the interaction type and generates a brief explanation describing the possible cause, potential health effects, and medical advice. A web-based interface developed using the Flask framework allows users to easily input drug names and obtain results. The proposed system demonstrates the potential of artificial intelligence in improving drug safety awareness.

Keywords: *Drug–Drug Interaction, BioBERT, Deep Learning, Natural Language Processing, Healthcare AI.*

AI-Based Emotion Recognition from Voice with Relief & Recommendation System

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Abstract

Speech Emotion Recognition (SER) has emerged as a crucial component in enhancing human–computer interaction by enabling systems to understand and respond to human emotions through vocal signals. This project presents an Audio Emotion Recognition and Emotion-Based Recommendation System that identifies emotional states from speech and provides context-aware suggestions to support users' mental well-being. The system employs a robust preprocessing pipeline involving noise removal, normalization, and data augmentation techniques such as time shifting, pitch shifting, and noise addition. Mel-Frequency Cepstral Coefficients (MFCCs) are extracted as primary acoustic features due to their effectiveness in representing emotional characteristics of speech. Deep learning models, including Convolutional Neural Networks (CNN) and Long Short-Term Memory (LSTM) networks, are utilized to capture both spatial and temporal patterns present in audio signals. While CNNs efficiently learn discriminative speech features, LSTMs model long-term temporal dependencies crucial for emotion classification. Upon successful emotion detection, the system activates a recommendation module that delivers personalized suggestions such as motivational content, relaxation techniques, or focus-enhancing activities based on the recognized emotional state. Experimental results demonstrate that the proposed approach achieves high accuracy and generalization performance, validating its effectiveness for real-world applications. The system highlights the potential of integrating SER with recommendation mechanisms in domains such as mental health support, education, and intelligent voice-based assistants, while also emphasizing the importance of ethical and privacy considerations in emotion-aware systems.

Development and Mechanical Evaluation of Hybrid Woven Sisal–Flax Fibre Composites for Lightweight Aerospace Structures

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Abstract

This research work investigates the mechanical properties of a sisal/flax hybrid polymer composite made using epoxy resin, designed for lightweight applications. Hybrid composites are prepared using the hand lay-up method, with sisal and flax fibers hybridized in different percentages. The prepared specimens will be subjected to tensile, bending, and impact tests to evaluate their mechanical properties based on the hybridization of the fibers. The objective of this research work is to explore the effect of sisal/flax hybridization on the strength, stiffness, and failure modes of the composite and to determine an optimal hybrid composition for lightweight, environmentally friendly, and non-structural applications.

Keywords: Sisal fibre, Flax fibre, Hybrid composite, Plain woven laminate, Epoxy resin, Mechanical properties, Lightweight applications.

Reaction Wheel Stabilization for Micro Missiles

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Abstract

This work presents the computer-aided design (CAD) and conceptual analysis of a reaction-wheel stabilized micro missile system. Modern micro missile platforms require efficient attitude control mechanisms while maintaining compact size and minimal aerodynamic drag. Conventional roll control methods rely heavily on aerodynamic surfaces such as fins or control vanes. Continuous deflection of these surfaces during steady flight introduces additional aerodynamic drag and increases actuator usage, leading to higher energy consumption and mechanical wear. To address this limitation, the present study explores the integration of an internal momentum-exchange device in the form of a reaction wheel to assist roll stabilization. A detailed three-dimensional CAD model of the micro missile structure was developed, incorporating an internal reaction wheel assembly aligned along the roll axis. The design process focused on structural layout, geometric feasibility, component integration, and appropriate mass distribution to maintain the center of gravity near the desired location. Basic analytical calculations were performed to estimate the moment of inertia, angular velocity, angular momentum, and the torque generated by the reaction wheel system. These calculations demonstrate that a compact flywheel rotating at high speed can generate sufficient control torque to assist roll motion. The reaction wheel mechanism provides an internal control moment without requiring continuous aerodynamic surface deflection. The proposed design offers a conceptual framework for implementing momentum-based stabilization in small aerospace vehicles. The CAD model developed in this work establishes a foundation for future studies involving dynamic modeling, control system development, and experimental validation. The approach can contribute to the development of efficient hybrid control systems combining internal momentum devices and conventional aerodynamic control methods for micro missile platforms.

FAUTH AI : A MULTIMODAL DEEPFAKE DETECTION USING DEEP LEARNING

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Abstract:

Deepfake technology has significantly advanced in recent years, enabling the creation of highly realistic manipulated images, videos, and audio that can spread misinformation and threaten digital trust. FauthAI is proposed as a multimodal deepfake detection framework designed to identify such manipulated media effectively. The system analyzes multiple types of media simultaneously, improving the reliability and accuracy of detection compared to traditional single-modality approaches.

The framework applies different deep learning models to process each media type. Convolutional Neural Networks (CNNs) are used to detect spatial artifacts in images, while Recurrent Neural Networks (RNNs) and Long Short-Term Memory (LSTM) networks capture temporal inconsistencies in video sequences. For audio analysis, spectrogram-based models are utilized to identify patterns associated with synthetic or manipulated audio signals.

In addition to spatial and temporal analysis, the system examines frequency-domain artifacts and extracts meaningful features from each media modality. These extracted features help identify subtle inconsistencies that may not be visible to the human eye, thereby improving the overall detection capability of the framework.

To enhance detection performance, FauthAI integrates the extracted features using multimodal fusion and ensemble learning techniques. This approach allows the system to combine information from images, videos, and audio, resulting in more accurate and robust identification of deepfake content . Furthermore, the proposed framework is designed to be scalable and adaptable to emerging deepfake generation techniques. Its flexible architecture enables continuous improvement and makes it suitable for real-world media forensics, digital security, and misinformation detection applications.

Keywords: Deepfake Detection, Multimodal Learning, CNN, RNN, LSTM, Spectrogram Analysis, Frequency-Domain Analysis, Media Forensics, Ensemble Learning, Artificial Intelligence

Mind Trace Empowering Mental Wellness Through Digital Insights

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Abstract

Modern mental health challenges, specifically stress, anxiety, and depression, often remain undetected due to their invisible progression, typically reaching a clinical crisis point before intervention occurs. To address this gap, this paper proposes MindTrace, an AI-driven digital phenotyping framework designed for proactive emotional well-being monitoring. Digital phenotyping represents the "moment-by-moment" quantification of an individual's psychological state in situ through the passive analysis of digital footprints. The proposed system safely aggregates user-authorized data from search query histories and social media interactions on platforms like Facebook and Instagram. The core technical engine utilizes Natural Language Processing (NLP) and state-of-the-art Transformer models, specifically BERT (Bidirectional Encoder Representations from Transformers), to detect subtle linguistic markers and behavioral shifts-such as social withdrawal patterns or negative sentiment frequency-that indicate burnout or depressive episodes. A central tenet of the MindTrace architecture is its privacy-first design, which utilizes secure data ingestion via a Chrome Browser Extension and ensures that sensitive information is stored in a privacy-protected local environment. All psychological insights are visualized on a longitudinal, easy-to-read dashboard built with Chart.js, enabling users to track their mental health trends in real-time. By transforming raw digital exhaust into actionable insights, MindTrace empowers individuals to recognize the need for self-care or professional support early in the symptom cycle, ensuring that mental health is prioritized alongside physical health.

Keywords: MT-MindTrace, AI-Artificial Intelligence, BERT- Bidirectional Encoder Representations from Transformers

RETENTION PRO - DATA QUALITY AWARE CUSTOMER RETENTION PREDICTION

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Abstract

Customer retention has become an important focus for many businesses, as keeping existing customers is usually more cost-effective than attracting new ones. However, predicting whether a customer will stay or leave a service can be difficult when the available data contains quality issues. Problems such as missing values, duplicate records, inconsistent data formats, and noisy information

can reduce the accuracy of machine learning models. Therefore, improving data quality before building predictive models is an essential step.

This project presents a Data Quality-Aware Customer Retention Prediction System that combines data quality analysis with machine learning techniques. The system first analyzes the dataset to identify common data quality problems such as missing values, duplicates, outliers, and inconsistencies. After detecting these issues, different preprocessing techniques such as data cleaning, normalization, and feature engineering are applied to improve the quality of the dataset. Once the data quality is enhanced, machine learning models are trained to predict customer retention more effectively. The project also compares model performance before and after data quality improvement to highlight the impact of clean and reliable data on prediction accuracy. Different algorithms such as Logistic Regression, Random Forest, and Gradient Boosting are used to determine which model performs best for customer retention prediction.

In addition, the system includes a user-friendly interface where users can upload datasets, view data quality reports, explore visual insights, and obtain customer retention predictions. By combining data quality assessment with predictive modeling, the proposed system helps organizations make better data-driven decisions and improve their customer retention strategies.

Keywords: Customer Retention Prediction, Data Quality Analysis, Data Cleaning, Machine Learning, Predictive Analytics, Data Preprocessing, Feature Engineering, Random Forest, Logistic Regression

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