

PROCEEDINGS OF INTERNATIONAL CONFERENCE ON INTEGRATED RESEARCH AND SUSTAINABLE DEVELOPMENT (ICIRSD-2025)

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Shri Balasaheb Mane Shikshan Prasarak Mandal's

ASHOKRAO MANE GROUP OF INSTITUTIONS

AN AUTONOMOUS INSTITUTE

Vathar Tarf Vadgaon, Tal. Hatkanangale,
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CONFERENCE PROCEEDINGS

International Conference on Integrated
Research and Sustainable Development
(ICIRSD - 2025)

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ABOUT AMGOI

Established in 2009 under the aegis of Shri Balasaheb Mane Shikshan Prasarak Mandal, Ashokrao Mane Group of Institutions (AMGOI), Vathar, is a premier Autonomous institute dedicated to excellence in technology and management education, with a strong commitment to empowering rural communities. Approved by AICTE, recognized by DTE, and affiliated with DBATU, Lonere and Shivaji University, Kolhapur, the institute offers Eight B.Tech, Five M.Tech, and MBA programs with industry-aligned curricula designed to meet global standards. AMGOI is equipped with state-of-the-art laboratories, smart classrooms, a fully digital central library, and advanced research and innovation facilities. The institute fosters a vibrant research culture through funded projects, interdisciplinary learning, and strong industry collaborations. The Training & Placement Cell consistently connects students with top recruiters, enabling them to acquire cutting-edge skills through ATAL workshops, skill development programs, hands-on projects, and industry interactions. With a legacy of academic excellence, innovation, and community service, AMGOI actively organizes national and international conferences, workshops, seminars, and collaborative research initiatives, shaping globally competent professionals prepared for Industry 4.0 and beyond.

ABOUT CONFERENCE

The International Conference on Integrated Research and Sustainable Development (ICIRSD – 2025) plays a vital role in promoting innovation and global collaboration among researchers, academicians, industry professionals, policymakers, and students. In the era of rapid technological advancement and environmental challenges, this conference provides a multidisciplinary platform to explore the synergy between technology, sustainability, and societal development.

The conference emphasizes the integration of intelligent technologies, smart systems, and sustainable practices to address key global issues such as climate change, resource optimization, energy efficiency, and digital transformation. It seeks to bridge the gap between research and real-world applications by encouraging evidence-based solutions that can be implemented across diverse sectors such as agriculture, transportation, manufacturing, healthcare, and infrastructure.

ICIRSD-2025 also highlights the importance of Intelligent Technologies and Next-Gen Computing track focuses on artificial intelligence, IoT, machine learning, and advanced computing to enhance automation and intelligent decision-making. The Smart Systems, Energy and Sustainable Infrastructure track emphasizes innovative approaches in renewable energy, smart grids, and sustainable urban development. The Innovation, Sustainability, and Business Intelligence track integrates technology, analytics, and sustainable practices to promote responsible growth and efficient resource management. Together, these tracks encourage interdisciplinary research that advances intelligent, energy-efficient, and sustainable global solutions.



OBJECTIVES OF THE CONFERENCE

- ◆ Encourage collaborative research across multiple disciplines—engineering, management, science, and social studies—to foster innovative and sustainable technological solutions.
- ◆ Provide a global platform for researchers, academicians, and industry experts to share the latest findings, emerging technologies, and best practices in the fields of intelligent systems, smart computing, and sustainability.
- ◆ Bridge the gap between academic research and industrial applications by fostering partnerships that lead to innovative products, technologies, and sustainable development models.
- ◆ Inspire participants to transform research ideas into practical innovations and entrepreneurial ventures that can address current and future global challenges.
- ◆ Provide opportunities for participants to publish their work in reputed Springer and Scopus-indexed journals, thereby increasing global visibility and recognition of their contributions.
- ◆ Build a strong network of researchers and professionals who can collaborate on projects, joint publications, and future interdisciplinary initiatives.

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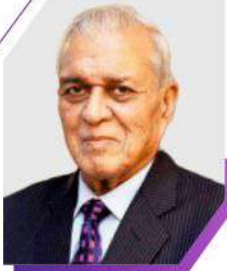
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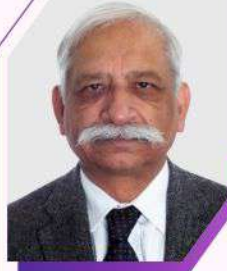
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The International Conference on Integrated Research and Sustainable Development (ICIRSD) is a premier interdisciplinary platform that brings together researchers, academicians, policymakers, industry experts and students from around the globe. The conference will be held at Shri Balasaheb Mane Shikshan Prasarak Mandal's Ashokrao Mane Group of Institutions (Autonomous), Vathar Tarf Vadgaon, Tal. Hatkanangale, Dist. Kolhapur, Maharashtra, India on 30th, 31st October and 1st November 2025.

TOPICS OF CONFERENCE

The conference will cover a wide range of topics including but not limited to the following-

◆ **Track 1: INTELLIGENT TECHNOLOGIES AND NEXT-GEN COMPUTING**

Artificial Intelligence and Machine Learning Applications, Cloud Computing and Big Data Analytics, Cyber Security and Blockchain, IoT and Embedded Systems, Signal and Image Processing, 5G/6G and Wireless Communication Systems, Smart Sensors and Network Design, Robotics and Automation.

◆ **Track 2: SMART SYSTEMS, ENERGY AND SUSTAINABLE INFRASTRUCTURE**

Smart Grids and Renewable Energy Systems, Electric Vehicles and Sustainable Transportation, Energy Efficiency in Industrial Systems, Sustainable Design in Mechanical Structures, Green Buildings and Smart Cities, Infrastructure Monitoring and Structural Health, Environmental Impact Assessment and Waste Management, Automation in Manufacturing and Control Systems.

◆ **Track 3: INNOVATION, SUSTAINABILITY AND BUSINESS INTELLIGENCE**

Innovation Management and Sustainable Development, Green Supply Chain and Circular Economy, Data-Driven Decision Making and Business Analytics, Entrepreneurship and Technology Commercialization, Industry 4.0 and Digital Transformation, Social, Environmental and Governance in Business, Policy, Ethics and Leadership in Tech-driven Societies, Integration of Engineering Solutions into Business Strategy.

CONFERENCE PUBLICATIONS

- ◆ All accepted and presented papers will be published in the Conference Proceeding with ISBN.
- ◆ Selected papers will be published in Springer Series (Scopus Indexed) with additional charges and subject to fulfillment of Springer norms.
- ◆ High Quality papers will be peer reviewed and published in Scopus Indexed Journals by Bentham Science Publishers with separate Article Processing Charges.

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INDEX

SR. NO.	PAPER ID	PAPER TITLE	PAGE NO.
1	4	Improving Deepfake Detection Around Lips and Eye Area Using Sparse Google Net	1
2	12	Attention-Based Image Captioning Using CNN and Bidirectional LSTM on Flickr8k Dataset	1
3	13	Hybrid Autoencoder and YOLOv8-PAM Architecture for Accurate UAV Crop Type Recognition	2
4	15	Shallow water acoustic networks using sensor network	2
5	17	Smart Agriculture through IoT and Q-Learning: A Sustainable Approach to Plant Growth Monitoring and Resource Efficiency	3
6	20	A Two-Stage Ensemble Framework with Feature Engineering and Borderline-SMOTE for Rare Attack Detection in NSL-KDD	4
7	23	Leveraging Contrastive Learning and Masked Autoencoders for Robust Surface Defect Classification in Data-Scarce Environments	5
8	25	Person Identification with Metric Learning Using Privileged Information	5
9	29	Blockchain for V2V Energy Trading: Sharding, Committee Consensus, and Layer-2 Rollups – A Comparative Simulation Study	6
10	31	Fortifying NVMs: A Review of Security Challenges, Solutions, and Future Prospects	7
11	34	Predicting Customer Needs Using Social Media Analysis	8
12	39	Academic Performance Assessment of a Student Using Machine Learning	9
13	40	Recommender System Framework for Orthopedic Health Services	9
14	41	A Deep Learning Approach For Sugarcane Yield Prediction from UAV Imagery	10
15	50	Multi-Scale Economic Simulation and Market Forecasts via Machine Learning	11
16	53	Optimization of emotion recognition system using facial expressions	12
17	54	Developments in AI-Powered Cybersecurity Awareness, Training and Threat Reduction: An Extensive Analysis of Multisector Approaches and New Technologies	13
18	55	Deep Learning Techniques to Give an extensive review on lung cancer detection using Neural Network	14
19	63	DeepShield: A Hybrid AI Framework for Detecting and Preventing Deepfake Attacks	15
20	65	Talk to Build: Natural Language Powered Website Generation with AgenticAI	16
21	71	A Blockchain Based Autonomous Notarization System for Authenticity and Document Preservation	16
22	72	Deep Learning and UAV-Based Height Estimation of Pomegranate for Smart Agriculture	17
23	74	Secure Data Aggregation and Broadcast Tree Construction for Industrial Wireless Sensor Network: An Overview Networks	18
24	75	Real Time Video Segmentation for Object Tracking	19

SR. NO.	PAPER ID	PAPER TITLE	PAGE NO.
25	76	Enhancing Neural Style Transfer for Multi-Style and Semantic preservation	20
26	81	A comprehensive review of ai-based Personalized rehabilitation systems for Chronic disease patient's healthcare	21
27	82	Agricultural Diagnostic Interface for Sugarcane Disease Detection Using Hybrid Deep Learning Models	22
28	83	Smart Surveillance system using image processing	22
29	85	Optimizing Grant Management in Salesforce: A Strategic Approach to Efficiency and Impact	23
30	93	Organoid Intelligence: A systematic review of Artificial Intelligence in Organoid Technology	23
31	96	Leveraging Bi-LSTM and Attention Mechanism for Symptom-Based Disease Forecasting	24
32	99	Hybrid Deep Learning Framework for Software Defect Prediction with Metaheuristic Optimization	25
33	121	Semi-Supervised Diabetic Retinopathy Classification via EfficientNet-L2 and Confidence-Based Pseudo Labeling	25
34	122	Enhancing UAV Object Detection in Diverse Environmental Conditions through Transfer Learning using Lightweight Neural Network	26
35	124	Deep Learning Approach for Speech Recognition with Wavelet Multi-Resolution and CNN-LSTM Integration	26
36	130	TinyML in Agriculture: Applications, Challenges, and Future Direction	27
37	139	Enhancing Movie Success Prediction: Integrating NLP and Advanced Machine Learning Models for Accurate Forecasting	27
38	142	Enhancing Driver Safety: Real-Time Traffic Sign Detection and Adaptive Speed Control with YOLOv5"	28
39	145	Quantum-Assisted Green Cloud Computing: A Sustainable Approach to Energy-Efficient, Distributed Infrastructure	28
40	149	AI-Based Integrated Traffic Violation Detection & Smart Traffic Management System	29
41	150	Gear Defect Detection Using Hybrid CNN-LSTM	29
42	151	A Comprehensive Review on Nature-Inspired Hybrid Optimization Techniques for Load Balancing in Heterogeneous Fog Computing Systems	30
43	152	Advancing Deep Learning-Driven Medical Image Re-construction: Multimodal Integration and Explainable AI for Efficient Cervical Cancer Detection	30
44	158	Multimodal AI for Clinical Decision Support: An Comprehensive Review of Fusion Strategies, Applications, and Deployment Challenges	31

SR. NO.	PAPER ID	PAPER TITLE	PAGE NO.
45	159	Secure IoT-Enabled ESP32 Wi-Fi Repeater with Intrusion Detection, Traffic Visualization, and Firewall: Towards a Scalable Raspberry Pi-Based Cybersecurity Router	31
46	161	An Analytical Study of Cybersecurity Preparedness in Cooperative Banks of Satara, Sangli, and Kolhapur Districts: A Literature Review	32
47	162	Deep Learning Approaches in Eye Tracking: Applications for Mouse Cursor Movement and Automated Clicking	33
48	163	A Comprehensive Review of Blockchain Frameworks for Secure Banking Transactions Using Hashing and Cryptographic Signatures	34
49	165	Deep Learning Approach for Blood group Prediction from Fingerprint Patterns	34
50	166	Deepfake Recognition Using Artificial Intelligence	35
51	167	Adaptive Voice-Controlled PC Assistant	35
52	169	ShuffleNet V2 vs. MobileNet V2: A Benchmarking Study on Computational Efficiency and Accuracy in Transfer Learning	36
53	174	Literature Review: Optimal Cloud Utilization and Threat Analysis in Mobile Environments with Reference to Satara District	37
54	177	Unsupervised Anomaly Detection for Predictive Maintenance of PMDC Motors Using Multi-Sensor Fusion and Machine Learning.	38
55	178	Wearable Smart Blind Shoes: An IoT-Enabled Edge Based Assistive Solution	39
56	182	Prediction of Diabetic Retinopathy using Deep Learning Techniques	39
57	184	Advances in Deep Learning and Hybrid Neural Networks for Leukemia Diagnosis: A Review	40
58	185	Plant Disease Detection Using CNN	41
59	186	Machine Learning Approaches for Cardiovascular Disease Risk Prediction in the Post COVID 19 Vaccination Era: A Systematic Review	41
60	190	IoT-Enabled Rover for Bomb Diffusion Applications	42
61	194	Advancing PCB Quality Control with YOLOv8-Based Defect Detection	42
62	195	Oil Spill Detection on Sea Using RADAR Technology	43
63	199	Towards Patient-Centered Care: Machine Learning Approaches for Holistic Multi-Disease Diagnostics	43
64	200	Performance analysis of Custom Dataset using CNN Model for Real Time Facial Emotion Recognition	44
65	201	IOT Based Intelligent Wheelchair	44
66	205	Autonomous Robotic Systems for Fall Armyworm Detec-tion and Eradication	45
67	213	Energy Conservation in Mobile WSNs through PSO-Based Multihop Clustering and Sleep Scheduling	46

SR. NO.	PAPER ID	PAPER TITLE	PAGE NO.
68	214	Multi-Disease Classification in Crops Using Multi-Modal Leaf Image Fusion and Attention Mechanisms	47
69	227	Machine Learning Based Boiler Health Monitoring System Using IoT	48
70	232	IoT-Integrated Multi-Sensor Robot for 360° Surveillance and Security	48
71	247	Arduino-Based Automatic Seed Sowing Robot for Precision Agriculture	49
72	248	Self-Sovereign Identity (SSI) for Agricultural Product Delivery using Blockchain	50
73	252	A Smart Cloud-Enabled Lane Change and Drowsiness Monitoring System for Heavy Vehicles	51
74	260	Smart College Navigation System	51
75	261	Brain tumor segmentation using multi-scale attention U-Net with EfficientNetB4 encoder for enhanced MRI analysis	52
76	262	Anomaly Detection in the Cloud Environment with Attack Graph Analysis Optimization Model for Intrusion Detection System Using Sensor Placement	52
77	270	Detection and Grading of Black Rot Disease on Grape Plant by Using ANN and Fuzzy Logic	53
78	276	Automatic Identification of Potential Respondents to Subjective & Objective Questions	53
79	280	Evaluation and Interpretation of Urban Air Pollution Using Soft Computing Technique	54
80	281	Comparative Evaluation of Deep Learning Models for Apple Fruit Disease Classification	54
81	285	Automated Classification of Multi-Class Skin Diseases Using a DenseNet201 Deep Learning Framework	55
82	301	Circuit-Level Improvement using Adaptive Rectifier and Matching in RF Energy Harvesting	56
83	305	A Review of Techniques for Detecting Audio Copy-Move Forgery in Digital Forensics	57
84	306	Deep Learning and NLP based Dynamic Product recommendations System Using Multimodal Sentiments Recognition	58
85	307	A Hybrid Virtual Try-On System Using Pose Estimation and Generative AI	58
86	318	DYPTAM: A Customized MOODLE Platform for Effective Teaching Learning- A Case Study	59
87	327	Virtually Controlling Computer Using Hand Gesture	60
88	332	Real-time Construction Site Safety Management Using Deep Learning	60
89	342	Deep Learning-Based Speech Emotion Recognition: Challenges and Opportunities in Autism Spectrum Disorder	61
90	347	Performance Evaluation of Traditional and CNN-Driven Image Steganography for Medical Chest X-Ray Data	62

SR. NO.	PAPER ID	PAPER TITLE	PAGE NO.
91	351	Real-Time Monitoring of Carbon Monoxide Emissions and Engine Temperature in Vehicles	63
92	352	Identification of Nutritional Deficiencies in Grape Vine Leaves through hybrid CNN and Deep Q Network model	64
93	355	Integrated Smart Braille System for the Visually Impaired: A Systematic Review and Proposed Framework	65
94	358	B-Tree Deduplication with Fingerprint Indexing	65
95	360	Ai powered energy optimaztion	66
96	362	GraphQL Vulnerability Scanner: A Novel Framework for Securing Modern APIs	66
97	363	Sustainable Post-Harvest Onion Storage System for Quality Preservation	67
98	365	Hybrid Analytical Models for Financial Fraud Detection	67
99	372	Development of a Solar-Powered Multi-Motor Electric Vehicle with Intelligent Battery Management System	68
100	377	Near-Infrared Spectroscopy Driven Embedded System for Smart Plastic Waste segregation	68
101	393	Design and Simulation of AI-Based PWM Controlled Cascaded H Bridge Multilevel Inverter for Residential Applications	69
102	405	NextGen Interview Portal: An AI-Powered Virtual Recruitment System with Integrated Multi-Stage Assessment and Advanced Proctoring	69
103	407	Towards Audio Deepfake Detection for Indian Lan guages: Dataset Creation and Baseline Analysis	70
104	8	Durability Performance of Concrete Incorporating Waste Glass Powder under Chloride and Sulphate Exposure	71
105	16	A Comprehensive Review of Blockchain Frameworks for Secure Banking Transactions Using Hashing and Cryptographic Signatures	72
106	24	Miniaturized 3.5W Switch Mode Power Supply for IoT Applications	73
107	26	Design and Development of a Static Wireless Charging Facility with Height Adjustment for Electric Vehicles	74
108	30	Delay Analysis of Construction Projects: A Case Study in Ratnagiri District	75
109	35	Recognition And Identification of Road Pavement Cracks Through Images By using Machine Learning Algorithm	76
110	43	Self-Curing Concrete: A Review of Mechanisms, Materials, and Performance	77
111	48	Enhancing Housing Construction Quality: A Review of Six Sigma and Traditional Quality Control Integration	78

SR. NO.	PAPER ID	PAPER TITLE	PAGE NO.
112	84	RFID and GPS Integration for Automated Bus Fare Calculation and Route Optimization	78
113	88	Impact of 5S Implementation at Machine Shop: A Case Study	79
114	97	AI driven driveway lane follower with Speech assistance	80
115	100	Productivity Enhancement of Spur Gear Machining Line through Lean Tools and Bottleneck Cycle Time Reduction	80
116	103	Reducing Lead Time in Sub-Assembly Levels: Analyzing and Optimizing Non-Value-Added Activities at kiwi Industries	81
117	104	Integration of Emerging Technologies for Sustainable Development: A Review on Renewable Energy, Smart Infrastructure, and Digital Solution	82
118	105	A Review of Artificial Intelligence Applications in Manufacturing Operations	83
119	128	Productivity Enhancement in Manual Assembly Lines by Using Software: A Case Study Approach	83
120	129	A Mini Review of Effects of textile wastewater on human health, the environment and its environmental impact assessment and management	84
121	136	Passive Cell Balancing In EV Modeling Using MATLAB	85
122	138	Investigation on Artificial Intelligence-Powered Web Interaction Bot for Enhanced and Dynamic Browsing	85
123	154	Performance Evaluation of SS-304 Solar Still: Experimental and ANSYS-CFD Approach	86
124	156	Weed Management in Indian Agriculture: Towards Automated and Sustainable Solutions	87
125	160	Investigation on Hybrid Footstep and Vehicular Pressure Energy Harvesting System with Advanced Storage Solutions	88
126	168	Evaluation of Existing Structures Using Rebound Hammer Testing	89
127	179	Comparative analysis of dry, flood, MQL and cryogenic machining of EN19 steel	89
128	180	Construction Cost Estimation Using Machine Learning	90
129	176	Integrating Artificial Intelligence with Solar Fabric Greenhouse Technology: A Review and Framework for Future Sustainable Agriculture	91
130	181	A Contemporary Review: Directional Solidification and its Critical Role in Mitigating Casting Defects and Enhancing Product Quality	92
131	188	Global Disparities in Electric Vehicle Charging Infrastructure: A Comprehensive Assessment of Technological Readiness and Distribution Patterns	92
132	203	Case Study on Lean Manufacturing: Implementation and Results in a Medium-Sized Auto Parts Manufacturer	93
133	208	Review on Design of Industrial Gear Box	93
134	212	Coin-Based EV Charging Station Using Arduino	93

SR. NO.	PAPER ID	PAPER TITLE	PAGE NO.
135	215	Impact of Modular Construction on Project Execution & Cost Efficiency	94
136	234	Design and Development of a Smart and Portable Oil Skimmer	94
137	235	A GA-TOPSIS Multi-Objective Optimization of Inconel 718 Turning with a Self-Propelled Rotary Tool	95
138	238	A Review on seismic performance of tall structure with Transfer structure and Backstay effect	95
139	239	Interaction Buckling Behavior in Cold-Formed Steel Column	96
140	241	Integrating Advanced Software Andvalue Engineering for Enhancement of Time and Cost in a Residential Building Project	96
141	242	Earned Value Management & Risk Analysis of an Industrial Project Using Advanced Software	97
142	243	An Analysis to Identify the Willingness of Commuters to Support the Metro Transit System in Mumbai Metropolitan Region (MMR)	98
143	249	Study of Waste Heat Sources in Vapor Compression Systems and a Case Study on the Heat Recovery Unit of a Bulk Milk Cooler	99
144	250	A Review on the Impact of Geometric Configuration on The Structural Integrity of Tensegrity Footbridge	99
145	264	AI in Seismic Design of RC Frames: A State-of-the-Art Review	100
146	266	Design and Development of Solar based Water Purification and Off-Grid Energy Utility System	100
147	268	Analysis of various defect at various speed and the size of defect of deep groove ball bearing	101
148	271	Automated Irrigation System based on IOT Technology Powered by Solar Panel	101
149	286	Design an efficient battery management system for two-wheeler EV.	102
150	287	Self-Redevelopment: A Strategy for Affordable Housing	103
151	295	A Review on Vinyl Ester Composites	103
152	298	The Contact Analysis for Deep Groove Ball Bearing Based on MATLAB And ANSYS	104
153	299	Energy Dissipation and Signal Analysis of Ball-Surface Defects in SKF 16003 Bearing	105
154	300	Predictive Analytics in Motorsports: An AI-Integrated Modular Telemetry System with Custom Sensor Housing	106
155	303	Finite Element Modal and Buckling Analysis of SKF 6312 Deep Groove Ball Bearing	107
156	308	Implementation Of Schedule Health Checks for Project Management	108
157	309	Vibration Analysis and Bearing Life Estimation of 'LMK20UU' and 'SMK20G-LUU' Bearings in Sealing Machines	109
158	312	AutoGreen: Smart Robotic Lawn Maintenance with Solar Power and Wireless Control	110

SR. NO.	PAPER ID	PAPER TITLE	PAGE NO.
159	315	Finite element analysis for Deep groove ball Bearing Based on Hertzian theory and ansys	110
160	321	Review Paper on Vibration Simulation of Ball Bearings	111
161	329	Study of Geo Environmental Parameters of Warana River Basin	112
162	339	A Comprehensive Review of Post-Casting Cleaning Techniques for Tractor Oil Pans: From Conventional Methods to Advance	112
163	343	A Comprehensive Review of Technology for Gasoline Direct Injection Engines: Advancements, Challenges, and Future Perspectives	113
164	356	A State-of-the-Art Review on Expanded Metal mesh as structural material	113
165	357	A Smart Mouse Interface for Detecting Mental Fatigue	114
166	364	RC Frames Under Quake Loading: A Fragility Study	114
167	366	Design and Analysis of Propeller Blades used in Drone Application	115
168	370	Review Paper on Rolling Element Bearing Daignostics	116
169	374	Optimization of turning of Al7075 nano composites under compressed air -cooling using TOPSIS approach	117
170	379	AI-Based Arc Fault Detection in Electrical Distribution Systems	117
171	381	Smart PLC controlled milk dispensing system with precision flow measurement for small scale dairy farms	118
172	382	AI-Enabled Smart Grid-Connected Solar Inverter with IoT- Based Fault Detection and Load Forecasting	119
173	383	Design And Implementation of Low-Cost Power Line Inspection Robot	119
174	384	GSM-Based Remote Energy Meter with Load Control and Mobile Billing	120
175	385	PLC Based Material Sorting System	120
176	387	Floating Capacitor Integrated DAB for Wireless Charging Application	121
177	389	Inverter Switch Fault Diagnosis System for BLDC Motor Drives	121
178	390	Voltage Regulation of KY Converter Using PI Controller	122
179	395	Automatic Monitoring and Protection of Machines by Using PLC & SCADA	122
180	397	Control And Monitoring of Electrical Drive for EV Applications	123
181	398	Design and Implementation of a Closed-Loop Buck-Boost Converter for EV Application	124
182	402	Design, Manufacturing and Testing of Composite Bricks Using Bagasse Ash, Bamboo Fibers and Lime Stone	124
183	406	Mathematical Modeling of Hole Diameter Error and Analysis of the Effect of Machining Factors in Flood Coolant Drilling using RSM and Minitab	125

SR. NO.	PAPER ID	PAPER TITLE	PAGE NO.
184	1	A Deep Learning-Based Sentiment Analysis Framework for social media and YouTube Comment Mining	125
185	14	Advance Driver Monitoring System [ADMS]	126
186	19	Causality Enabled Ontology Mapping	126
187	131	Bhutan's Sustainable Development: A Conceptual Study Based on Secondary Sources.	127
188	173	A Study of Muslim Women's Participation in Household Financial Planning & Management in Sangli District: A Systematic Review	127
189	157	Integrating Lost Sales and Random Deterioration in Inventory Control Models	128
190	183	Equity in Hybrid Work: Bridging the gap between Remote and Office-Based Employees	129
191	192	Cross Learning Opportunities between Services and Manufacturing Innovation	129
192	206	A Research Paper on How Gen Z Shops with AI: Adoption, Trust and Purchase Outcomes – An Empirical Study	130
193	210	Exploring the Interrelationships among Quality of Work Life Dimensions: An Internal Consistency Study of Foundry Employees in Shirol MIDC.	130
194	211	Literature Review: Consumer Engagement in the Digital Age: A Review of Literature on Retailers & Marketing Strategies	131
195	219	Automatic Multi-Recipe Chemical Mixing and Auto-Cleaning System Using PLC	132
196	220	Sustainable Vegetable Marketing Models: Farmer-to-Consumer Practices among Farmer-Producer Companies in Pune District	133
197	222	A Comprehensive Analytical Investigation into the Opportunities, Constraints, and Socio-Economic Implications of Women Entrepreneurs Engaged in Agri-Tourism: Evidence from Pune District, Maharashtra	134
198	251	The Impact of Mergers and Acquisitions: A Comprehensive Review of Theoretical and Empirical Evidence	135
199	273	A study on examining the impact of alternative work schedule on employee health and productivity with reference to Menon and Menon Ltd. Kolhapur.	135
200	288	A Review of Mathematical Models for Predicting Climate Change Impacts on Ecosystems: Frameworks, Applications, and Future Directions	136
201	313	Impact of HR Policies on Employee Efficiency in Vishwakarma Founders (India) Pvt. Ltd. Shirol	137
202	348	Comprehensive Review on Smart Waste Management and Segregation Systems	138
203	375	The Assessment of Advanced English Learners for Effective and Better Written English Communication	139
204	376	Judicial Decentralization and Justice-Led Development A Management Approach for Sustainable Community Growth	140

SR. NO.	PAPER ID	PAPER TITLE	PAGE NO.
205	341	Comparative Performance of Selected Natural Coagulants in Low-Cost Water Purification Models	141
206	399	Novel Developments in Digital Printing Techniques through Integration of Intelligent Systems for Sustainable Manufacturing and Smart Product Development	141
207	310	Process of E-filing of ITR1 and Benefits from old tax regime to new tax regime for taxpayers from Kolhapur	142
208	45	Experimental Assessment of Bond Behavior and Structural Performance of High Strength Concrete Beam-Column Joints under Static Load	142
209	146	Blockchain in Cloud Computing: From Theoretical Promise to Practical Scalability and Future-Proofing	143
210	5	Artificial Intelligence in Bone Cancer Diagnosis: A Comprehensive Review of Methods and Emerging Trends	143
211	325	Dynamic Model for Vibration Studies of Deep Groove Ball Bearings Considering Single and Multiple Defects in Races of ball bearing 6202-2Z	144
212	98	Analysis and Validation of Stress Concentration for Different Cutout Orientations in Plates	145
213	322	Advancing Banana Leaf Disease Diagnosis through Machine Vision and Artificial Intelligence	145
214	218	Planning, Scheduling, and Delay Analysis of a Commercial Building Using Microsoft Project (MSP): A Case Study	146
215	67	An Open Hardware Approach to PCB Track Design Automation: Integrating Stepper Motors, ServoControl, and G-code Interpretation	146
216	196	A Review of Mechanical Engineering Innovations for Sustainable Agricultural Advancements	147
217	272	Seismic Analysis of R.C. Structure with Floating Column by Analysis and Shake Table Test	148
218	311	Investment Preference Analysis of KOZIMASHI Bank of Secondary School Teachers of selected villages in Hatkanangale Taluka	149
219	314	Key Components of Training and Development for Employee Growth and Contribution at Sahyadri Motors Pvt. Ltd., Sangli.	150
220	403	A Review of Bearing Failure Modes	151
221	191	Intelligent Perception: A Deep Learning Approach to Fruit Detection and Ripeness Classification	151
222	373	Integrating Renewable Energy and Diesel Power: A Hybrid Approach for Efficient EV Charging Stations	152

SR. NO.	PAPER ID	PAPER TITLE	PAGE NO.
223	401	Fpga Based Multicore Design to Enhance Power Efficiency	152
224	404	SignSpeak: Real-Time Gesture to Text and Audio for Speech Impaired	153
225	316	Study Efficient Management of Equipment & Manpower in Construction Projects	153
226	189	Construction Equipment Management: Understanding On-Site Influencing Factors	154
227	221	Feasibility management and maintenance in highway construction zone	154
228	297	Recent Developments in Cobalt Oxide Electrode Materials for Enhanced Supercapacitor Performance	155
229	302	Groundwater Quality Assessment for Domestic and Agricultural Purpose in Upper Part of River Vedganga basin using GIS Maharashtra, India	155
230	277	Optimal Inventory Management and Pricing Strategies for Perishable Products: A Comprehensive Review	156
231	68	Agri-Tech Innovation in India: A Review of Opportunities, Challenges, and Future Pathways	157
232	79	Enhancing Productivity in Retail Pharmacy Through the Application of Quality Tools – A Case Study	158
233	324	Robust Video Surveillance: A Comparative Analysis of Spatio-Temporal Models for Crowded Scene Anomaly Detection	159
234	259	ESP32-Based Bluetooth Mesh Sensor Network for Data Collection and Command & Control	160
235	106	Impact Of Poor Workmanship on Construction Industry - High Rise Buildings	161
236	134	An overview of Context Aware Sentiment Classification using Deep Learning Techniques	161
237	198	Design, Analysis and Manufacturing of Pressure Testing Fixture to Reduce the Leakage in Tee Bend Casting Component	162
238	414	A Review on Auto-Generated Carbon Credit Software System	162
239	418	Object Tracking using Template Matching Algorithm	163
240	415	Optimized Bidirectional DC to DC Converter for Solar PV Application	163
241	245	A Review Paper on Vibration Analysis of Shaft	164
242	417	Design Evolution of a Dual-Band Microstrip Patch Antenna Using DGS and U-Slots for 5G NR Bands	164
243	42	Comprehensive Survey on Blockchain and IoT Based HER Analysis using IoT and Deep Learning	165
244	233	Comparative behavior of high-rise building provided with RCC, PSC and steel virtual outriggers	166
245	284	Degree Engineering Teacher's Investment Analysis: Institutes under Jurisdiction of Shivaji University, Kolhapur & Dr. Babasaheb Ambedkar Technological University, Lonere (Non-Autonomous institutes of Kolhapur City)	167

SR. NO.	PAPER ID	PAPER TITLE	PAGE NO.
246	353	“Investigation and analysis of layer thickness and infill pattern on tensile strength of PLA material in 3D printing.”	167
247	170	Cloud Computing for Resource Optimization and Security in Rural Cooperative Credit Societies	168
248	56	Implementation of Maize Plant Leaf Disease Detection Using Convolutional Neural Networks	169
249	107	Structural Assessment and Strengthening of RCC Columns Using Non-Destructive Testing and Finite Element Modelling	170
250	361	Use cases of artificial intelligence in education, agriculture and healthcare: Advances and challenges	170
251	411	DNA-Based Data Storage System	171
252	359	Embodied Energy Assessment of Conventional and Alternative Building Materials for Sustainable Infrastructure in Western Maharashtra, India	171
253	320	Prototype Development for Smart Irrigation and Crop Protection to Vegetable Farms in Agricultural Areas Adjacent to Forests	172
254	410	Review Paper: Automation in Spray Pond Systems for Enhanced Cooling Efficiency in Sugar Industries	173
255	140	An Integrated IoT Architecture for Real-Time Anti-Poaching and Forest Monitoring Using a Multi-Sensor Network	174

Improving Deepfake Detection Around Lips and Eye Area Using Sparse Google Net

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Abstract:

Deepfake technology allows for very realistic facial manipulations, and it becomes harder to identify real from fake content. Although useful in media creation, it is dangerous in terms of misinformation and cybercrime. This review discusses recent Deepfake detection techniques based on deep neural networks (DNNs), with special focus on Meta the Sparse Dense Google Net architecture for improving model generalization. The revealed objective data is used to improve robustness detection. The focus is in particular on the detection of consistency of small faces, especially around the eyes and lips. In this review, we grouped Deepfake methods across five broad categories and [1] analyzed their identification methods according to their performance and approach. We further explore existing data records and trends to improve the language of a more robust detection system. In this review we are going to is Deepfake content growth in upcoming year, we are also going to discuss challenges face during detection of deepfake.

Keywords: Deepfake Detection, Sparse Dense Google Net, Meta Deepfake Detection (MDD), Facial Manipulation, Confusion Matrix.

Attention-Based Image Captioning Using CNN and Bidirectional LSTM on Flickr8k Dataset

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Abstract:

This study presents an image captioning model that integrates a Convolutional Neural Network (CNN) encoder with an attention-based Long Short-Term Memory (LSTM) decoder to generate natural language descriptions for images. Utilizing the Flickr8k dataset, the model extracts high-level visual features using a pre-trained VGG19 network and applies a bidirectional LSTM with attention to align visual content with textual generation. Quantitative evaluation using BLEU scores reveals strong unigram and bigram precision, while qualitative analysis confirms the model's ability to identify key objects and actions. Despite challenges in generating complex or semantically rich captions, the model demonstrates a solid baseline for future enhancements. Potential improvements include better regularization, advanced decoding strategies, and larger datasets to enhance generalization.

Keywords: Image Captioning, Attention Mechanism, LSTM, CNN Encoder

Hybrid Autoencoder and YOLOv8-PAM Architecture for Accurate UAV Crop Type Recognition

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Abstract:

This paper presents a hybrid deep learning framework for accurate classification of agricultural crops from UAV imagery. The proposed method integrates a convolutional Autoencoder for unsupervised feature compression with a YOLOv8 classifier enhanced by a Pyramid Attention Module (PAM). The Autoencoder reduces high-resolution images into compact latent vectors, preserving semantic content while minimizing noise. These representations are passed to a PAM-integrated YOLOv8, which adaptively emphasizes discriminative spatial and channel-wise features across scales. Tested on a 30-class agricultural crop dataset, the model achieves 69.67% top-1 and 91.5% top-5 accuracy. Visualizations using Grad-CAM and t-SNE confirm strong inter class separability and focus on crop specific features. The approach combines accuracy, efficiency, and interpretability, offering a scalable solution for UAV-based precision agriculture.

Keywords: Autoencoder, YOLOv8, Pyramid Attention Module, deep learning, agricultural monitoring.

Shallow Water Acoustic Networks Using Sensor Network

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Abstract:

Shallow Water Acoustic Networks (SWANs) using Wireless Sensor Networks (WSNs) and sonar systems are an emerging technology for underwater monitoring, communication, and exploration. These systems leverage acoustic signals for robust communication in shallow water environments where electromagnetic waves are ineffective. The integration of WSNs with sonar technology enables efficient data collection, transmission, and analysis for applications such as marine habitat monitoring, underwater surveillance, disaster prediction, and resource exploration. This paper explores the architecture and operational principles of SWANs, emphasizing their ability to overcome challenges specific to shallow water environments, such as multipath propagation, ambient noise, and dynamic topology. The proposed system incorporates advanced sonar techniques for reliable acoustic communication and low-power WSNs to ensure energy efficiency and scalability. Furthermore, it addresses key issues like synchronization, data aggregation, and real-time network adaptability. Simulation and experimental results demonstrate the effectiveness of the integrated approach in achieving high data fidelity, prolonged network lifetime, and enhanced communication range. The findings underscore the potential of SWANs to revolutionize underwater communication systems, offering practical solutions for sustainable ocean resource management and exploration.

Keywords: Shallow Water Acoustic Networks, Wireless Sensor Networks, sonar systems, underwater communication, energy efficiency, data aggregation.

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Smart Agriculture through IoT and Q-Learning: A Sustainable Approach to Plant Growth Monitoring and Resource Efficiency

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Abstract:

The convergence of the Internet of Things (IoT) and machine learning is transforming precision agriculture by enabling data-driven optimization of plant growth in varying environments. This study explores the integration of IoT-based sensing with reinforcement learning, specifically Q-learning, to enhance plant growth management in both controlled and natural field conditions. The primary aim is to derive actionable insights that boost crop productivity while conserving resources. An IoT-enabled system was designed to capture real-time information from sensors monitoring soil temperature, soil moisture, air temperature, humidity, and growth parameters. Controlled experiments simulated ideal growth settings, whereas on-field trials reflected natural variability. These datasets were analysed using a Q-learning algorithm, allowing the system to make adaptive decisions and optimize plant development. Iterative learning enabled the framework to establish links between environmental factors and plant responses, dynamically adjusting irrigation and environmental controls based on feedback. Experimental results demonstrated that the controlled setup yielded greater consistency in growth and higher resource efficiency due to its stability. In contrast, the on-field system underscored adaptability by generating strategies to cope with environmental uncertainty. This dual evaluation highlights the combined potential of IoT and reinforcement learning to support sustainable agriculture. The findings validate IoT-based adaptive monitoring as a practical tool for optimizing plant growth. The proposed approach offers pathways to improve crop yields, minimize input use, and promote long-term sustainability. Future research will extend the framework to diverse crops, enhance Q-learning models for complex decision making, and integrate additional environmental parameters for comprehensive analysis.

Keywords: Sentiment Analysis, social media, Feature Extraction, Machine Learning, NLP, XGBoost, SVM, Naïve Bayes.

A Two-Stage Ensemble Framework with Feature Engineering and Borderline-SMOTE for Rare Attack Detection in NSL-KDD

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Abstract:

Network intrusion detection systems (IDS) are essential for securing digital infrastructures but struggle to detect rare attacks like Remote-to-Local (R2L) and User-to-Root (U2R) due to severe class imbalance in datasets like NSL-KDD, where these attacks constitute less than 1% of samples. This research proposes a two-stage intrusion detection system (IDS) framework to prioritize high-impact threat detection. Stage 1 employs a Random Forest classifier with balanced weights for binary classification, achieving a recall of 0.7700 to ensure attack detection. Stage 2 uses Borderline-SMOTE to oversample rare classes, followed by a Random Forest for multiclass classification, attaining an overall accuracy of 0.9617. The framework excels in detecting rare attacks, with macro-F1 scores of 0.91 for R2L and 0.90 for U2R, significantly outperforming baseline IDS (F1-scores of 0.00 and 0.08, respectively). By integrating domain-specific feature engineering and targeted oversampling, this approach enhances generalization and sensitivity to rare threats while maintaining computational efficiency. Compared to baselines, our method improves recall by 84% for R2L and 96% for U2R, making it ideal for resource constrained environments like IoT and edge networks. This framework offers a robust, scalable solution for real-world IDS, prioritizing critical attack detection.

Keywords: Two stage Intrusion Detection System Rare Attack Borderline SMOTE Random Forest Imbalanced Data Wireless Networks

Leveraging Contrastive Learning and Masked Autoencoders for Robust Surface Defect Classification in Data-Scarce Environments

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Abstract:

Surface defect detection in industrial settings is extremely challenging task due to the scarcity of annotated data and high variability in defect appearance. This study presents a comparative analysis of two self-supervised learning approaches—contrastive learning (SimCLR) and masked autoencoders (MAE)—for metal surface defect classification using the NEU dataset. The models were pretrained with unlabeled data and fine-tuned under low supervision. SimCLR performed better with 100% accuracy and F1-score, surpassing MAE with an accuracy of 91%. On the low-label setting (10% data), SimCLR had good performance (83% accuracy) and MAE had poor performance (39% accuracy). The findings attest to the superiority of SimCLR's robustness, efficiency, and applicability to industrial defect inspection. The study exhibits the promise of self-supervised pretraining in lessening dependence on labeled data and suggests a scalable approach to real-world visual inspection problems.

Keywords: SimCLR, MAE, Surface detection, Neu dataset

Person Identification with Metric Learning Using Privileged Information

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Abstract:

Person re-identification (Re-ID) in video surveillance refers to the duty as signed of identifying individuals throughout several, not crossing camera views in real time. This paper presents an approach for real-time monitoring and re-identifying individuals that leverages a multi-camera system with three distinct viewpoints. The system addresses difficulties like variation in appearance, occlusions, changes in clothing, and diverse environmental conditions by implementing inter-camera communication for feature sharing and collaborative identification. In order to capture unique and consistent characteristics of people, this paper provides a strong framework of foreground and background subtraction for feature extraction utilizing deep learning-based techniques. For camera-to-camera communication, the system uses a mesh topology, which guarantees low-latency and high-accuracy re-identification even in the face of environmental changes such as illumination, position, and backdrop fluctuations. In order to minimize the time, lag between real-time surveillance and processing, the technique additionally incorporates dynamic frame selection to maximize the feature extraction process. This page compiles the person re-identification analysis study paradigms. It looks at the latest advancements in human re-identification, including significant problems, datasets, and innovative methods.

Keywords: Person Re-Identification, Real-Time Tracking, Multi-Camera System, Deep Learning, Surveillance Security

Blockchain for V2V Energy Trading: Sharding, Committee Consensus, and Layer-2 Rollups – A Comparative Simulation Study

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Abstract:

The Internet of Electric Vehicles (IoEV) enables decentralized peer-to-peer (P2P) energy trading but demands blockchain consensus protocols that balance scalability, latency, and energy efficiency. Practical Byzantine Fault Tolerance (PBFT), though widely used, suffers from quadratic communication overhead, limiting its suitability for large vehicular networks. This paper presents a comparative simulation of four consensus mechanisms—baseline PBFT, sharded-PBFT, committee-based gossip consensus, and Layer-2 rollup enhanced PBFT—within a unified IoEV trading framework. Using a reproducible Google Colab environment, we evaluated the throughput, commit latency, communication energy cost, and transaction reliability across multiple seeds and scalability sweeps. The results show that rollup-enhanced PBFT maintains a high throughput (96 tps) while reducing the energy cost by 94% compared to the baseline PBFT, making it highly efficient for bandwidth-constrained settings. Committee-based consensus achieves the lowest latency (0.125 s), but sacrifices throughput, whereas sharded-PBFT incurs significant cross-shard losses (~39%). These findings provide actionable benchmarks for deploying scalable, efficient, and reliable blockchain solutions for IoEV systems.

Keywords: Blockchain, IoEV, V2V energy trading, consensus, scalability, rollups, sharding, committees.

Fortifying NVMs: A Review of Security Challenges, Solutions, and Future Prospects

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Abstract:

In calculations of supply data, the use of Non-volatile memory (NVM) becomes essential. To ensure this, the AEM of memory maintains proper operation when the gadget is not in operation thus, the technology requires an electric absorption force. Nevertheless, there are some applications of the given device, which lead to security risks including side-channel attacks, durability, and information leaks or unauthorized access. This paper underpins a critical discussion of security weaknesses associated with NVM technologies on the basis of a critical examination of the NVM technologies, and the security weaknesses that have so far been recognized in the critical examination of the NVM technologies. It examines some of the risk-reduction measures including enhanced encryption-based defences, hardware-based security and expert measures that may be adopted to eliminate side channel attacks. The article also discusses the latest method with the enhancement in NVM security including blockchain-based authentication systems and AI-enabled security systems and cryptography techniques, designed to counter the upcoming quantum attacks or quantum attacks. The trade-off between strong security, system performance and NVM components life is also investigated. This work incorporates existing and current methodologies in the discipline, which is keen to major trade-offs and possible young developments of research by addressing current challenges through purging the vulnerabilities that continue to exist in the field of computing technology as well as challenges ahead of us.

Keywords: Non-volatile memory, Encryption-based protection, Side channel attack, Hardware security modules.

Predicting Customer Needs Using Social Media Analysis

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Abstract:

In the digital era, social media has emerged as a powerful communication platform where customers openly express their opinions, preferences, and expectations. Businesses can leverage this vast, unstructured data to gain critical insights into evolving customer needs. This study focuses on the use of social media analysis to predict future customer demands, enabling companies to remain proactive and competitive. By collecting data from platforms such as Twitter, Facebook, Instagram, and online forums, we apply advanced analytical techniques including sentiment analysis, topic modeling, trend detection, and machine learning-based predictive algorithms. The approach enables the identification of emerging patterns, customer pain points, and shifting consumer behaviors in near real-time. Unlike traditional methods of market research, which are often reactive and time-consuming, social media analysis provides continuous, up-to-date information directly from the customers themselves. This predictive capability empowers businesses to adapt their strategies, develop innovative products, improve customer engagement, and meet future demands more effectively. Furthermore, the study highlights the importance of filtering noise and addressing challenges such as data privacy, language diversity, and sentiment ambiguity to ensure the accuracy of predictions. The findings emphasize that businesses which proactively anticipate future customer needs through social media analysis are better positioned to achieve sustainable growth and maintain a competitive edge in an increasingly dynamic marketplace.

Keywords: Social Media Analysis, Customer Prediction, Sentiment Analysis, Trend Detection, Machine Learning, Predictive Analysis

Academic Performance Assessment of a Student Using Machine Learning

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Abstract:

The accurate measurement of student academic performance is becoming an essential part in modern educational systems, provides early intrusion, differentiated support. A student should be assessed throughout the year to improve their performance for future career. Therefore, Machine Learning is a powerful tool to predict student performance to enhance their academic performance as well as career preparedness. The prediction and analysis by using Machine learning is one of the popular ways to discover the student's performance. The research recommended machine learning-based prediction and assessment of a student by analyzing wide range of features including academic history, behavioral patterns, and demographic information. Here various classification models are studied which shows the difference between traditional methods and advanced methods for student assessment. It will be helpful for institution, teacher as well as student for proper decision making. The result provides modern predictive systems which identify students of different levels in advance which enable early intervention measures by maximizing educational resources.

Keywords: Student Academic Performance, Prediction, Machine Learning, behavioral patterns, educational resources

Recommender System Framework for Orthopedic Health Services

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Abstract:

Access to proper healthcare services is a critical part for patient. Patients often face challenges in finding the most appropriate health centers due to the large quantity of hospitals, services and facilities available over there and lack of proper decision-making tools. Patient centric care has become a central aim for the Nation's health system. The concept of patient centric care has gained increasing prominence in recent years as a key aim of the India health care system. A health services recommender system can help patients in selecting the appropriate medical facility based on various factors like specialization, location, availability and patient feedback. This research paper explains about recommender system framework designed to access orthopedic healthcare services by a patient. The framework aims to minimize the effort and time required for patients to access proper healthcare support improving overall healthcare accessibility and efficiency.

Keywords: healthcare services, recommender system, decision-making tools, medical facility, framework

A Deep Learning Approach for Sugarcane Yield Prediction from UAV Imagery

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Abstract:

This study presents a deep learning-based framework for predicting sugarcane yield using high-resolution imagery captured by unmanned aerial vehicles (UAVs). The objective is to develop a reliable and automated system capable of replacing conventional yield estimation methods, which are often labour intensive and limited in scalability. The proposed approach utilizes UAV-acquired RGB images collected at various crop growth stages, ensuring a comprehensive representation of field variability. Each Ortho mosaic image was divided into fixed-size patches of 512×512 pixels, with each patch typically encompassing 2–3 sugarcane plants. These image patches were subsequently resized to 224×224 pixels to meet the input requirements of convolutional neural networks (CNNs). Ground-truth yield data were obtained through direct field measurements and paired with the corresponding image patches to form the training dataset. Multiple pre-trained CNN architectures, including ResNet-50, VGG-16, Inception-V3, and DenseNet-201, were fine-tuned using transfer learning techniques to perform regression tasks for continuous yield prediction. The models were evaluated using standard performance metrics such as Root Mean Squared Error (RMSE), Mean Absolute Error (MAE), and R² score. Among the models, VGG-16 demonstrated the highest accuracy, achieving the lowest RMSE, while the other models also yielded competitive results. The results validate the effectiveness of deep learning models in capturing complex visual patterns associated with crop yield. The developed system offers a scalable and non-invasive alternative to traditional field-based estimation methods. Its integration into agricultural workflows can enhance decision making, optimize resource use, and support long-term monitoring across diverse agro-ecological zones.

Keywords: Sugarcane yield prediction, UAV, Deep learning, Regression, Precision agriculture

Multi-Scale Economic Simulation and Market Forecasts via Machine Learning

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Abstract:

The rapid growth of global financial markets, coupled with the increasing complexity of economic systems, necessitates the development of advanced methodologies for accurate analysis and prediction. This study presents a synergistic approach to economic system simulation and stock market prediction by leveraging Big Data analytics alongside powerful machine learning techniques. By integrating vast and heterogeneous datasets including historical stock prices, economic indicators, social media sentiment, and global news this innovative approach facilitates the identification of hidden patterns, emerging market trends, and potential anomalies that might otherwise go unnoticed. Utilizing machine learning models, particularly those grounded in both supervised and unsupervised learning methodologies, significantly enhances predictive accuracy while allowing for adaptability to dynamic market conditions that frequently evolve. The proposed framework not only offers real-time, data-driven insights but also plays a crucial role in risk mitigation and informed decision-making for both investors and policymakers. Through the detailed simulation of economic behaviors and comprehensive predictive analysis of stock market activities, this synergistic methodology demonstrates substantial potential in shaping future financial strategies. Furthermore, it enhances the robustness of economic forecasting, enabling stakeholders to navigate complexities with greater confidence. Overall, by effectively harnessing the power of advanced analytics and machine learning, this study contributes to the ongoing evolution of financial market strategies in an increasingly interconnected global economy.

Optimization of emotion recognition system using facial expressions

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Abstract:

Human-computer interaction (HCI) significantly depends on facial expressions, which serve as one of the most fundamental and universal forms of nonverbal communication. Accurate recognition of emotions from facial expressions has become a key research area, as it enables more natural and effective interaction between humans and machines. Traditional machine learning techniques for facial emotion recognition often face limitations due to their reliance on handcrafted feature extraction and reduced adaptability across diverse datasets. To address these challenges, this work presents an optimized Convolutional Neural Network (CNN)-based emotion recognition system trained on the FER-2013 dataset. The proposed approach integrates essential steps such as preprocessing to enhance image quality, data augmentation to improve generalization, and model optimization to achieve higher efficiency and robustness. Experimental evaluation demonstrates that the optimized CNN achieves an accuracy of 97.2%, outperforming conventional CNN architectures and light weight models like MobileNet by 2.3% and 4.5%, respectively. Furthermore, to enhance accessibility for regional users, the identified emotion labels are translated into Marathi using the Google Convert API, bridging the gap between deep learning techniques and multilingual applications. This system highlights the potential of combining deep learning with language adaptability, thereby advancing emotion-aware intelligent systems for real-world applications.

Keywords: Image Processing, Deep Neural Networks, Emotion Detection

Developments in AI-Powered Cybersecurity Awareness, Training and Threat Reduction: An Extensive Analysis of Multisector Approaches and New Technologies

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Abstract:

The need for advanced Cybersecurity awareness, training and risk mitigation techniques is growing across a number of sectors due to the rapid rise in cyber threats. This survey reviews thirty-four recent IEEE contributions to assess how new technologies, particularly artificial intelligence (AI), simulation-based learning, and extended reality (XR), are being used in cybersecurity education and defense practices. The study covers a variety of areas, including critical infrastructure protection, the Internet of Medical Things (IoMT), healthcare data security, financial fraud prevention, military training, and intelligent vehicle networks. Key topics include designing and evaluating curriculum frameworks, using critical games for pre-teens, AI-driven threat detection and predictive modeling, cyber range exercises for skill building, and models for interdisciplinary collaboration. Through a structured nine-cluster thematic analysis, the review emphasizes both sector-specific uses and cross-domain approaches. It shows how machine learning, federated learning, and risk-based awareness programs can help address technological vulnerabilities and human behavior issues. Key challenges include fragmented assessment metrics, resource-intensive technologies, sectoral silos, and a lack of focus on longterm behavior change. At the same time, promising research avenues emerge around knowledge transfer across sectors, scalable immersive training, culturally appropriate awareness platforms, and interpretive AI-enabled defense systems. By outlining progress, challenges, and opportunities, this paper provides a comprehensive knowledge base for educators, practitioners, and policymakers. It also serves as a guide for creating flexible, technology-driven cybersecurity awareness and training programs to meet changing global security needs.

Keywords: Cybersecurity, Awareness, Training, Artificial Intelligence.

Deep Learning Techniques to Give an extensive review on lung cancer detection using Neural Network

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Abstract:

Lung cancer remains as one of the major causes of cancer related deaths globally and patient survival generally hinges on early and accurate diagnosis. New developments in machine learning, especially deep learning have dramatically improved computer-assisted detection techniques in medical imaging. In this review, the advancements in several of such approaches, such as convolutional neural networks, ensemble approaches, attention-based models, and optimization-based models, are discussed, their diagnostic properties, benefits, and drawbacks are evaluated. There are still important challenges of scarcity of high-quality annotated datasets, imaging variation, and the inability to identify tiny nodules or those with low contrast. It is also stated that a hybrid framework combining high order segmentation, multi-level features, and interpretable mechanisms is introduced in the study to improve both accuracy and clinical usability. It is compared to the current methodology in terms of the emphasis on the contribution of such hybridized designs to the increment of the reliability of the diagnostic process and to the management of the challenges of trans-transparency of the decision-making process. In general, the survey presents current trends, uncovers gaps that remain, and hints at future directions to develop strong interpretable and clinically deployable systems to detect lung cancer. Such approaches can improve survival rates because they enable clinicians to diagnose cases earlier and more confidently due to the combination of technological innovation and practicality in the clinic.

Keywords: Lung cancer detection, deep learning, computed tomography, hybrid neural networks, attention mechanisms, explainable AI

DeepShield: A Hybrid AI Framework for Detecting and Preventing Deepfake Attacks

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Abstract:

The rapid advancement of synthetic media technologies has led to a surge in deepfake content, presenting substantial threats to digital authenticity, privacy, and public trust. This research proposes a comprehensive deep learning based framework designed to detect and prevent deepfake attacks with high accuracy and reliability. The system employs a hybrid neural architecture that combines convolutional and recurrent networks to capture spatial and temporal inconsistencies in manipulated videos. Detection is enhanced through training on diverse and realistic datasets, ensuring robustness against a wide range of forgery techniques. Beyond detection, the framework integrates proactive prevention mechanisms, including blockchain-based media verification, digital watermarking, adversarial noise generation, and content moderation filters. Real-time verification modules and anomaly detection algorithms add multiple layers of decision-making, reducing false positives and negatives. The system also features an explainability component, offering interpretable insights to support forensic and content moderation efforts. Designed for scalability and real-world deployment, this multi-tiered architecture emphasizes continuous learning and adaptability, aiming to provide a dynamic and secure defense against evolving deepfake threats while promoting transparency and ethical AI use.

Keywords: Deepfake Detection, Hybrid Neural Network Model, Synthetic Media Prevention, Benchmark Datasets, Explainable Artificial Intelligence

Talk to Build: Natural Language Powered Website Generation with AgenticAI

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Abstract:

It has long been assumed that only people proficient in technology—those who understand how to write, design, and use advanced tools could create a website. Even though low-code and no-code platforms have made significant progress in streamlining things, they still sometimes include fixed templates or unattractive interfaces that can limit creativity and make them difficult for beginners to use. This project aims to close that gap by introducing a prompt-based website generator powered by AgenticAI. The big idea? Let anyone, no matter their technical know-how, build fully functional, responsive websites just by typing in natural language commands. At its core, the system is built on a smart architecture where multiple autonomous agents work together within the AgenticAI framework. These agents handle everything—from understanding what the user wants, to planning the site layout, writing the front-end code, and even deploying the final product. It's all driven by natural language processing combined with a system of task-sharing between intelligent agents. This means the system can operate on its own, smartly managing each step of the website-building process. By turning everyday instructions into custom, dynamic websites, this technology makes web development more approachable, efficient, and user-friendly for everyone.

Keywords: AgenticAI, Natural Language Processing, Intelligent Agents

A Blockchain Based Autonomous Notarization System for Authenticity and Document Preservation

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Abstract:

This paper presents the Secure Electronic Notarization system, which integrates blockchain technology, decentralized storage (IPFS), and AI-powered document summarization to address the key limitations of traditional notarization methods. By leveraging Ethereum for immutability, IPFS for decentralized storage, and AI for simplifying complex legal documents, the system offers a secure, efficient, and cost-effective alternative. Evaluation results demonstrate rapid notarization times (average 3 seconds), low operational costs, and high user satisfaction. The system ensures tamper-proof documentation, global accessibility, and enhanced transparency while providing users with an intuitive interface. Despite the promising outcomes, future work will focus on improving domain-specific AI models, optimizing scalability, and ensuring long-term document availability through redundancy mechanisms. This system has the potential to transform legal processes by making notarization more efficient, secure, and globally accessible.

Keywords: Blockchain, Autonomous notarization, Decentralization, Document preservation.

Deep Learning and UAV-Based Height Estimation of Pomegranate for Smart Agriculture

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Abstract:

This paper introduces a deep learning model for non-invasive pomegranate tree height estimation from drone-acquired imagery towards improving precision agriculture practices. High-resolution RGB images of pomegranate orchards were captured by a drone flying at an oblique angle of 45 degrees to achieve maximum tree structure and canopy feature visibility. Separate trees were manually segmented frame-wise, and corresponding height values were taken through field-based measurements to establish a reliable ground truth database. A ResNet-50 convolutional neural network, fine-tuned for regression tasks, was employed to predict continuous tree height values from segmented images. Image preprocessing, for resizing to 224×224 pixels, and pre-trained model fine-tuning using stochastic gradient descent with optimized hyper parameters were applied during training. The data was divided into training and testing subsets to evaluate model generalizability, with model performance measured using standard regression scores such as Root Mean Squared Error (RMSE). The result demonstrates that the model can accurately predict tree height from drone imagery, offering a scalable and automatized substitute for manual measurements. The approach has very high potential for large-scale orchard monitoring, growth analysis, and yield forecasting, ultimately supporting data-driven decision-making in horticultural crop management.

Keywords: UAV Remote Sensing, Canopy Height Estimation, Deep Neural Networks, ResNet Architecture, Crop Phenotyping, Precision Horticulture.

Secure Data Aggregation and Broadcast Tree Construction for Industrial Wireless Sensor Network: An Overview Networks

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Abstract:

Industrial Wireless Sensor Networks (IIWSNs) have become a cornerstone in monitoring and managing various industrial processes due to their efficient data gathering capabilities, flexibility, and reduced infrastructure costs. Secure Data Aggregation (SDA) and Broadcast Tree Construction (BTC) are critical to maximizing data reliability, confidentiality, and efficient energy consumption in IIWSNs. SDA in IIWSNs involves gathering and compressing sensor data to reduce redundancy and conserve bandwidth. As sensor data may traverse multiple nodes before reaching a central base station, the risk of data tampering and interception grows, making security paramount. Encryption-based aggregation techniques, such as homomorphic encryption and secure multiparty computation, are commonly implemented to ensure data confidentiality while allowing in-network processing. Meanwhile, lightweight cryptography methods, such as Elliptic Curve Cryptography (ECC) and pairwise key generation, have gained traction as they provide robust security with minimal energy costs, making them suitable for IIWSNs with resource constraints. BTC, on the other hand, focuses on optimizing the routing paths for data dissemination in a network by constructing efficient broadcast trees. The goal is to minimize latency and energy expenditure while ensuring that all nodes in the network can communicate securely. Approaches like Shortest Path Tree (SPT) and Minimum Spanning Tree (MST) algorithms are frequently used. However, secure BTC is challenging due to potential malicious nodes that may alter or reroute data, impacting network reliability. Advanced techniques, including trust-based routing and secure multi-hop broadcasting, have emerged to mitigate these risks. Integrating SDA with BTC offers a unified solution for secure and efficient data collection in IIWSNs. By reducing redundancies and optimizing communication paths, these approaches ensure that data is transmitted with minimal delay and maximum security, supporting robust industrial automation and decision-making. With advancements in AI and machine learning, future IIWSN frameworks may further optimize SDA and BTC, enhancing security and operational efficiency across industrial applications.

Keywords: Privacy-preserving, data aggregated, Data authenticity, Cryptography, Lightweight encryption for IIWSN, Secure multiparty computation, Attack-resistant

Real Time Video Segmentation for Object Tracking

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Abstract:

In computer vision, real-time video segmentation for object tracking is a crucial job with applications in robotics, augmented reality, autonomous driving, and surveillance. In order to precisely identify and track objects across video frames in real time, this research proposes an effective method that combines object tracking and video segmentation. The suggested approach combines a strong tracking algorithm with deep learning-based semantic segmentation to extract object boundaries and preserve identification across time, especially in the face of difficult circumstances such background clutter, motion blur, and occlusion. We optimize framewise processing with temporal coherence and use lightweight convolutional neural networks to attain real-time performance. Results from experiments on benchmark datasets show that our approach is appropriate for real-world applications since it maintains low latency while achieving excellent accuracy. The suggested framework offers a dependable and expandable way to comprehend dynamic scenes and make decisions in real time.

Keywords: Malware Detection, Deep Learning, SHAP, Model Interpretability

Enhancing Neural Style Transfer for Multi-Style and Semantic preservation

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Abstract:

Neural Style Transfer (NST) is a powerful technique that enables the transformation of content images into stylized representations by applying the artistic characteristics of a reference style image. While significant progress has been made, traditional NST methods face notable challenges when dealing with multi-style transfer and semantic preservation. Conventional approaches often blend multiple styles in a visually inconsistent manner, leading to the loss of critical content structures and semantic information. Additionally, these methods typically apply style uniformly across the image, ignoring the importance of preserving region-specific details that contribute to the image's semantic meaning. To address these limitations, this research introduces an enhanced Neural Style Transfer framework that simultaneously achieves effective multi-style blending and robust semantic preservation. The proposed method integrates attention mechanisms and semantic segmentation maps to guide the style transfer process, ensuring that stylistic elements are adaptively applied to appropriate regions without distorting the essential content. A multi-branch style encoder is employed to process multiple style inputs, allowing for flexible and harmonious style fusion. The system dynamically adjusts the contribution of each style based on the underlying semantic regions of the content image. Experimental results on diverse datasets demonstrate that the proposed approach produces visually compelling outputs with clear semantic structure and smooth style transitions. Quantitative evaluations using content and style loss metrics further confirm the superiority of the enhanced framework over existing NST methods. This work presents a significant step forward in advancing Neural Style Transfer techniques by enabling high-quality, multi-style transformations while preserving the semantic integrity of the original image.

Keywords: Neural Style Transfer, Multi-Style Blending, Semantic Preservation, Attention Mechanisms, Semantic Segmentation, Style Fusion

A Comprehensive Review of AI-Based Personalized Rehabilitation Systems for Chronic Disease Patient's Healthcare

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Abstract:

One of the most revolutionary developments in contemporary healthcare is the use of artificial intelligence (AI) in rehabilitation. Recent developments in machine learning (ML) technology have greatly increased the precision of medical, emergency, and illness diagnosis. Early detection of chronic diseases (CD) is crucial. The article discusses artificial intelligence's (AI) potential to predict a variety of chronic conditions as well as its application in rehabilitation. It also provides a comprehensive analysis of past research on AI-Based Personalized Rehabilitation Systems for chronic diseases including diabetes, liver issues, cancer, neurological disorders and cardiovascular disease. This review summarises results from observational research, randomised controlled trials (RCTs), systematic reviews, and experimental designs to investigate the development of AI-based personalised rehabilitation solutions. This article emphasises the advantages of adaptive therapies, increased patient participation, and better therapeutic results by combining research on a variety of applications, such as virtual reality (VR), robots, motion analysis, predictive modelling, and remote monitoring. Even with encouraging developments, problems including small sample numbers, inconsistent study designs, a lack of long-term data, and ethical issues still exist. The paper concludes with recommendations for further research that place an emphasis on cooperative training initiatives, extensive clinical validation, and the incorporation of ethical norms in order to support widespread clinical adoption.

Keywords: Artificial Intelligence, Personalized Rehabilitation, Healthcare, Virtual Reality, Robotics, Machine Learning, Remote Monitoring, Predictive Modelling.

Agricultural Diagnostic Interface for Sugarcane Disease Detection Using Hybrid Deep Learning Models

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Abstract:

Agricultural yield is crucial in ensuring food security and economic viability, particularly in countries where crops such as sugarcane are a primary source of livelihood. Early and precise identification of sugarcane diseases can significantly minimize crop loss and contribute to sustainable agriculture. A CNN and LSTM network for automated leaf disease detection in sugarcane is illustrated in this paper. The CNN learns spatial features from leaf images, while the LSTM learns temporal and sequential dependencies. Experimental results show enhanced classification performance compared to isolated models, corroborating the success of the CNN-LSTM architecture in real-world disease diagnosis applications. The dataset used in this work comprises 5,000 labeled sugarcane leaf images captured under various lighting and environmental conditions to facilitate model generalization. Data augmentation methods were employed to tackle class imbalance as well as robustness enhancement. The proposed model was accurate at 94.6%, far superior to baseline machine learning classifiers. This research paves the way for real-time, mobile-based disease diagnosis systems, facilitating timely interventions and supporting precision agriculture programs.

Keywords: CNN, LSTM, Disease Prediction, Disease Control Solution

Smart Surveillance System using Image Processing

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Abstract:

Intelligent surveillance system makes use of cutting-edge devices for real-time activity monitoring and analysis, such as cameras, sensors, and artificial intelligence (AI). Smart surveillance systems can identify faces, spot odd behavior, and give out alarms if something suspect occurs, in contrast to typical systems that only capture video. This facilitates speedier reactions to possible threats, which enhances security. To maintain safety and deter crime, the system can be used in a variety of settings, including residences, workplaces, public areas, and even transit networks. Smart surveillance systems provide a more effective and proactive method of environment monitoring by fusing real-time data with intelligent decision-making. Motion detection, facial recognition, object tracking, and anomaly detection are critical components of modern surveillance systems, achieved through advanced image processing algorithms and machine learning models. By reducing the need for human intervention, these technologies automate monitoring tasks and ensure timely alerts to security personnel. When integrated with existing security infrastructures, smart surveillance systems aim to enhance safety, reduce operational costs, and create more secure environments in both public and private settings.

Keywords: Camera, Intelligent, Surveillance, Anomaly Detection, Image Processing, Object Detection, heft Detection, Face Recognition.

Optimizing Grant Management in Salesforce: A Strategic Approach to Efficiency & Impact

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Abstract:

Grant management is vital for nonprofits, foundations, and institutions that depend on external funding, yet traditional methods like spreadsheets and emails often create inefficiencies, compliance risks, and limited visibility. Salesforce, a leading cloud-based CRM, provides a modern solution through its Nonprofit Cloud and Grants Management modules. These tools streamline the entire grant lifecycle—from application and review to disbursement, monitoring, and reporting—while offering automation, real-time analytics, centralized data, and collaboration features. By eliminating silos and ensuring data accuracy, Salesforce enhances efficiency, transparency, and accountability. It also supports compliance, audit readiness, and data-driven decision-making. This paper examines how Salesforce optimizes grant management through key features, implementation strategies, case studies, and best practices. In addition, it explores emerging trends such as AI-driven recommendations, blockchain-based transparency, mobile portals, and sustainability analytics, presenting a roadmap for organizations to strengthen donor trust, improve grantee satisfaction, and maximize long-term mission impact.

Keywords: Grant Management, Salesforce Nonprofit Cloud, Workflow Automation, Data Governance, Grantee Satisfaction, Fund Disbursement, Audit Readiness, Nonprofit CRM.

Organoid Intelligence: A systematic review of Artificial Intelligence in Organoid Technology

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Abstract:

Organoid technology is gaining a lot of attention from researchers. Organoids are small lab grown models that mimic the structure and function of the real organs. They are used in studying diseases, cancer, and testing new drugs but using traditional methods to examine organoids by hand is time consuming, not very reliable, and leads to inconsistent results. This makes it hard to do big studies. To solve these problems, scientists are using deep learning to automatically classify organoid images. This method is more accurate and can handle large amounts of data. Recent research is focused on improving models like convolutional neural networks (CNNs), Vision Transformers (ViT) and mixed CNN-ViT systems. They also use object detection and image segmentation tools such as YOLO and U-Net to identify and analyze different types of organoids including those from the intestine, Kidney, Colon, colorectal area, and retina. Using AI in organoid research makes the process more efficient and precise. Even though there have been many improvements, there are still challenges like not enough data, no standard testing methods, difficulty in applying these methods to different organoids, and limited use of combined data type. Because of this, there is need for a detailed review that looks at and evaluates deep learning techniques used for classifying organoids. This paper aims to bring together current approaches and identify areas where more work is needed, especially in making results scalable.

Keywords: Organoid, Deep Learning, Artificial Intelligence.

Leveraging Bi-LSTM and Attention Mechanism for Symptom-Based Disease Forecasting

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Abstract:

Accurate disease diagnosis plays a crucial role in modern healthcare systems, as early and precise identification of various illnesses significantly improves patient outcomes and treatment effectiveness. However, traditional diagnostic approaches often face inherent limitations such as dependence on physicians' subjective judgment, inconsistencies in interpretation, and time inefficiencies, especially when dealing with complex symptom descriptions. To overcome these issues, this work introduces an advanced deep learning technique that utilizes Bidirectional Long Short-Term Memory (BiLSTMs) network combined with an attention mechanism for automated disease prediction from patient symptom narratives. The model is carefully designed to preprocess natural language symptom data, effectively capturing both temporal and contextual dependencies within complex textual descriptions. To ensure practical accessibility, the trained model is deployed in real world through a Flask-based web interface, enabling real-time usage in practical healthcare settings. Experimental evaluation with 5-fold cross-validation demonstrates robust performance, the approach achieves a mean and final accuracy of 93.56% and 98.12% respectively. The proposed Bi-LSTM and attention mechanism for symptom-based disease forecasting system shows strong potential for telehealth and remote healthcare applications, offering an interpretable, scalable, and efficient solution for real-time disease prediction and assisting clinicians in critical decision-making tasks.

Keywords: Disease Prediction, BiLSTM, Attention Mechanism, Deep Learning, Natural Language Processing, Flask Web App.

Hybrid Deep Learning Framework for Software Defect Prediction with Metaheuristic Optimization

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Abstract: Software defect prediction, or SDP, is essential for improving software quality and reducing maintenance costs by identifying modules that are prone to faults early on. Prediction performance may be hampered by the uneven datasets and low generalizability across different software projects that plague traditional SDP models. In order to tackle these issues, this study suggests a hybrid strategy that combines metaheuristic optimization techniques like PSO (Particle Swarm Optimization) with deep learning and ensemble learning techniques like bagging, boosting, and stacking to enhance prediction accuracy and efficiency. Intelligent sampling is used by a metaheuristic algorithm to balance the dataset and improve model parameters and reliability, while a deep learning models such as CNN (Convolutional Neural Network) and BiLSTM (Bidirectional Long Short-Term Memory) extracts intricate patterns from software metrics. The suggested approach yields notable gains in accuracy metrics, especially when managing unbalanced data (defective samples are under-represented as compared to non-defective samples), according to experimental assessments conducted on many benchmark NASA datasets. Additionally, the model effectively generalizes to a variety of software projects, demonstrating its potential for real-world implementation. In general, the suggested method offers a strong and trustworthy way to improve software defect prediction systems.

Keywords: Software Defect Prediction (SDP), Deep Neural Networks, Metaheuristic Optimization, Imbalanced Data Handling, Software Quality Assurance, Predictive.

Semi-Supervised Diabetic Retinopathy Classification via EfficientNet-L2 and Confidence-Based Pseudo Labeling

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Abstract: One of the major eye diseases that leads to the vision loss among the adults globally is diabetic retinopathy (DR). Early detection of DR is necessary but challenging due to the need for detailed retinal image analysis and the limited availability of clinically annotated data. Pseudo labeling is technique in semi supervised learning that offers a powerful solution utilizing a labeled and unlabeled data both to enhance the performance of deep learning models. This paper presents an extensive investigation into pseudo-labeling approaches, reviewing seven significant works that have advanced its applications in medical image analysis, especially for DR detection. The strengths and restrictions of every approach in improving scalability and classification accuracy are underlined in this work. Moreover, we suggest a hybrid CNN structure for enhanced lesion detection in high resolution fundus pictures via EfficientNet-L2 integrated with pseudo-labeling. Advanced preprocessing, attention techniques, and iterative pseudo-label refining are included into the framework Comparative analysis shows how well pseudo-labeling handles data imbalance, enhances generalization, and reduces hand annotation work. By use of semi-supervised learning, our work adds to the increasing corpus of studies supporting accurate, useful, and pragmatic DR detection in deep learning.

Keywords: Pseudo-Labeling, Semi-Supervised Learning, Diabetic Retinopathy, Fundus Image Analysis

Enhancing UAV Object Detection in Diverse Environmental Conditions through Transfer Learning using Lightweight Neural Network

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Abstract:

This research introduces an enhanced method for small object detection in UAV acquired image collection by refining the YOLOv8 architecture for real-time use on hardware with limited computational power. The methodology integrates a streamlined training process using channel pruning, post-training quantization, and knowledge distillation. Specifically, YOLOv8m serves as the teacher network, while YOLOv8n is the optimized student model. The student network undergoes a forty percent channel reduction, is quantized to minimize resource usage, and is trained using Mean Squared Error-based distillation to preserve accuracy. Experimental evaluations indicate that the optimized YOLOv8n achieves performance levels comparable to its larger counterpart while being significantly more efficient, making it suitable for UAV-based deployments.

Keywords: UAV, Small Object Detection, YOLOv8, Knowledge Distillation

Deep Learning Approach for Speech Recognition with Wavelet Multi-Resolution and CNN-LSTM Integration

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Abstract:

The project describes design and building of system that can recognize emotions in speech using deep learning techniques. There are several kinds of time-frequency representations like mel-frequency cepstrum coefficients (MFCCs), spectrograms and mel- spectrograms are commonly used to develop an SER system. The system uses features called mel- spectrograms, which are processed through a combined structure that includes CNNs (convolutional neural networks) and LSTMs (long short-term memory networks). This combination helps model understand both visual and time-based aspects of sound. Additionally, a transformer-based Wav2Vec2 model is adjusted for emotion recognition, showing how useful pre-trained models can be in this area. The methods proposed here show good results in identifying emotions from speech and could be used in areas like human computer interaction and healthcare.

Keywords: deep learning, CNN, speech emotion recognition, LSTM, Wav2Vec2, mel-spectrogram, emotion classification, human-computer-interaction.

TinyML in Agriculture: Applications, Challenges, and Future Directions

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Abstract:

TinyML – running machine learning on low-power microcontrollers – is a promising approach to modernize farming in resource-constrained settings. This paper reviews TinyML applications for crops like rice, wheat, and ginger in Maharashtra, India, where connectivity and power are limited. We summarize recent studies on in-field TinyML systems (e.g. disease detection on leaf images, soil moisture prediction for irrigation) and outline the hardware/software frameworks enabling them. Key performance gains are highlighted: TinyML controllers often achieve >90% accuracy on tasks, with inference latencies of milliseconds and energy use orders of magnitude below cloud solutions. Notably, smart irrigation nodes using TinyML report ~40% irrigation water savings and ~20% crop yield gains [4], illustrating substantial resource efficiency. We survey representative use-cases in table form, and describe how tools like TensorFlow Lite Micro and Edge Impulse facilitate deployment. Challenges such as limited memory, robustness under field variability, and model update strategies are discussed. Emerging trends on device learning, federated TinyML, energy harvesting sensors, and LPWAN integration [30] [7] – are described as pathways for future autonomous farm AI. TinyML thus offers a scalable, sustainable precision-agriculture solution for smallholders without requiring constant cloud links.

Keywords: TinyML, precision agriculture, embedded AI, smart irrigation, edge computing

Enhancing Movie Success Prediction: Integrating NLP and Advanced Machine Learning Models for Accurate Forecasting

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Abstract:

This study examines how combining Natural Language Processing (NLP) with advanced machine learning techniques can be used to predict movie success and revenue. By integrating text analysis, sentiment data, and traditional movie attributes, the research develops predictive models using Gradient Boosting, Random Forest, and Neural Networks. The findings show that the Random Forest model excels in binary classification, achieving 99% accuracy in predicting movie success, while Gradient Boosting outperforms it in predicting revenue, demonstrating better learning efficiency and generalization. Although the neural network showed high training accuracy, it faced issues with overfitting. Overall, the study highlights the potential of hybrid models and deep learning approaches to enhance decision-making in the film industry, minimizing financial risks and optimizing production and marketing strategies.

Keywords: movie success prediction, NLP, machine learning

Enhancing Driver Safety: Real-Time Traffic Sign Detection and Adaptive Speed Control with YOLOv5

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Abstract:

This study presents an enhanced traffic sign recognition system using deep learning to improve detection accuracy and ensure real-time response in complex driving environments. A YOLOv5-based model was developed and trained on a custom dataset consisting of 36 traffic sign classes. The model demonstrated significant improvements in key performance metrics across 50 training epochs, achieving a precision of 0.911, recall of 0.767, and mAP50 of 0.542, confirming its robustness for realworld deployment. To extend its practical utility, the system integrates real time auditory feedback through the pyttsx3 text-to-speech engine, allowing drivers to receive immediate alerts about detected signs. Furthermore, adaptive speed control was implemented, enabling automatic adjustments based on recognized speed limit signs to promote compliance and enhance road safety. The proposed system not only strengthens driver awareness but also provides a proactive safety measure by minimizing human error and reaction delays. Overall, the integration of accurate sign detection, real time feedback, and adaptive control demonstrates the potential of deep learning-driven solutions in advancing intelligent transportation systems and fostering safer driving experiences.

Keywords: Real-Time Detection, Traffic Sign Recognition, Adaptive Speed Control, YOLOv5, Deep Learning, Intelligent Transportation Systems, Driver Safety

Quantum-Assisted Green Cloud Computing: A Sustainable Approach to Energy-Efficient, Distributed Infrastructure

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Abstract:

Cloud computing's rapid growth drives rising energy use and carbon emissions. This study presents Quantum-Assisted Green Cloud Computing, a framework combining quantum algorithms with green cloud strategies to optimize workload scheduling, renewable energy usage, and carbon footprint modeling. Techniques such as QAOA, VQE, and quantum machine learning improve forecasting and efficiency, while quantum cryptography enables secure, low-energy communication. A hybrid cloud-edge model supports quantum-optimized task offloading. Simulations using Qiskit/PennyLane and CloudSim/GreenCloud will benchmark against PUE, CUE, and WUE metrics, aiming to advance Quantum-Sustainable Cloud Infrastructure for scalable, eco-friendly computing.

Keywords: Energy-efficient infrastructure, Next-generation computing, Cloud sustainability

AI-Based Integrated Traffic Violation Detection and Smart Traffic Management System

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Abstract: Rapid urbanization and the increasing number of vehicles have intensified traffic congestion and road safety risks in Indian cities. Conventional enforcement approaches, which depend heavily on manual policing, are unable to cope with violations such as red-light jumping, riding without helmets, over-speeding, and lane indiscipline. Recent developments in Artificial Intelligence (AI), computer vision, and Internet of Things (IoT) technologies enable automated and scalable alternatives for traffic law enforcement. This paper proposes an AI-based integrated traffic violation detection and management framework designed for dense urban environments. The system employs lightweight YOLO models combined with vision transformers for multi-violation detection, optical character recognition (OCR) tuned for Indian license plate formats, and a rule-matching engine aligned with the Motor Vehicles Act. Additionally, blockchain based logging and federated learning are incorporated to ensure secure and privacy-preserving operation under the Digital Personal Data Protection Act (2023). Experimental evaluation demonstrates high detection accuracy, low processing latency, and reliable automated challan generation. The framework offers a pathway toward transparent, automated, and citizen-centric traffic enforcement within India's Smart City initiatives.

Keywords: Artificial Intelligence (AI), Traffic Violation Detection, YOLOv5, Federated Learning, Smart City, Deep Learning, Helmet Detection, Blockchain, Internet of Things (IoT), Intelligent Traffic Management System (ITMS).

Gear Defect Detection Using Hybrid CNN-LSTM

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Abstract: When gear systems malfunction, it can result in expensive downtime and safety risks. Gear systems are essential parts of mechanical and industrial applications. For predictive maintenance and operating effectiveness, gear failures must be accurately and promptly detected. Convolutional Neural Networks (CNN) and Long Short-Term Memory (LSTM) networks are used in this study's hybrid deep learning technique to identify gear problems from vibration signal data. To record the frequency-domain properties in the suggested system, raw vibration signals are first converted into spectrograms. The CNN layers are used to extract spatial characteristics from these spectrograms, and the LSTM layers are used to learn the patterns and temporal relationships linked to various gear defect types. By utilizing CNN's capabilities in visual feature extraction and LSTM's in sequence modeling, this integrated architecture improves detection accuracy. Several gear defect situations, including as wear, cracks, and fractured teeth, are included in the benchmark dataset used to train and verify the model. The CNN-LSTM hybrid model performs better in terms of classification accuracy and defect identification resilience than both independent deep learning models and conventional machine learning, according to experimental data. The suggested method presents a viable way to automatically and in real time check the status of gears in industrial settings

Keywords: Gear Defect Detection, CNN-LSTM Hybrid Model, Condition Monitoring, Vibration Analysis

A Comprehensive Review on Nature-Inspired Hybrid Optimization Techniques for Load Balancing in Heterogeneous Fog Computing Systems

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Abstract:

Fog computing is emerging as a vital paradigm to address the growing need for real-time data gathering and processing driven by the rapid rise of IoT applications. By extending cloud services to the network edge, fog computing reduces latency, enhances responsiveness, and minimizes bandwidth use. Yet, its decentralized nature and heterogeneous fog nodes pose significant challenges for achieving efficient load balancing. This study reviews recent advances in hybrid optimization techniques, particularly nature-inspired strategies, for dynamic load balancing in fog environments. Approaches such as genetic algorithms, particle swarm optimization, artificial neural networks, and reinforcement learning are evaluated for their suitability in heterogeneous systems. Findings suggest that hybrid models—especially those blending swarm intelligence with machine learning or reinforcement learning—outperform conventional methods in terms of throughput, response time, resource utilization, and adaptability. Nonetheless, practical barriers remain. Current models often struggle with energy inefficiency, scalability, fault tolerance, and lack of real-world validation, while also overlooking task dependencies, privacy, and security. Future research must prioritize energy-aware, fault-tolerant, secure, and scalable algorithms. Multi-objective optimization, predictive AI scheduling, and dynamic workflow management are essential to bridge simulation with real-world deployments, enabling reliable and intelligent fog computing solutions.

Keywords: heterogeneity, nature-inspired, optimization, fault tolerance, scalability

Advancing Deep Learning-Driven Medical Image Reconstruction: Multimodal Integration and Explainable AI for Efficient Cervical Cancer Detection

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Abstract:

Cervical cancer is one of the most preventable yet deadly cancers affecting women globally, particularly in low resource settings where access to timely and accurate screening is limited. The rise of artificial intelligence (AI) and deep learning offers a promising pathway to automate and enhance diagnostic processes. However, many existing deep learning models suffer from poor generalizability, a lack of clinical context integration, and limited explainability, thereby restricting their acceptance in real-world clinical scenarios. This research proposes a novel, lightweight convolutional neural network (CNN)-based architecture designed specifically for cervical cancer detection using the SIPaKMeD dataset. The system integrates both cytological image features and tabular clinical metadata to offer a multimodal diagnostic pipeline. Further, to address the “black box” nature of deep models, explainable AI (XAI) techniques such as Grad CAM and SHAP are embedded into the model to provide transparency in predictions.

Keywords: Cervical Cancer, SIPaKMeD, Convolutional Neural Network (CNN), Multimodal Fusion, Explainable AI (XAI), Grad-CAM, SHAP, Clinical Metadata, Lightweight Architecture Safety.

Multimodal AI for Clinical Decision Support: A Comprehensive Review of Fusion Strategies, Applications, and Deployment Challenges

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Abstract: In recent years, the development of multimodal artificial intelligence (AI) for clinical decision support has advanced rapidly. By integrating diverse sources of medical information such as imaging, electronic health records, genomics, and continuous sensor data, these models have achieved unprecedented accuracy in disease diagnosis, outcome prediction, and patient risk assessment. Unlike earlier systems that relied on single data types, multimodal approaches provide a more comprehensive view of patient health, improving reliability and clinical relevance. This review brings together recent studies that highlight the use of convolutional neural networks, transformer-based architectures, attention-driven fusion methods, and hybrid or ensemble frameworks. A comparative perspective is offered on how these models handle data integration, balance computational efficiency, and deliver interpretable results. Beyond technical performance, the discussion extends to challenges of clinical adoption, scalability across institutions, and maintaining generalizability in diverse healthcare settings. The review also critiques the strengths and weaknesses of existing methods, emphasizing issues such as resource requirements, transparency, and bias. Attention is given to emerging solutions like Parallel Orthogonal Deep Neural Networks, which promise to enhance robustness, efficiency, and compliance with healthcare regulations. The aim of this synthesis is to map the state of the art in multimodal AI for healthcare, highlight best practices in model design and deployment, and outline future research priorities that could drive safe, effective, and equitable clinical integration.

Keywords: Multimodal AI, Transformers, Medical Imaging, Data Fusion, Healthcare Informatics

Secure IoT-Enabled ESP32 Wi-Fi Repeater with Intrusion Detection, Traffic Visualization, and Firewall: Towards a Scalable Raspberry Pi-Based Cybersecurity Router

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Abstract: Wireless communication environments are now under serious risk due to the growing number of Internet of Things (IoT) devices. Although they increase coverage, traditional Wi-Fi repeaters frequently lack built-in security features like firewall enforcement and intrusion detection. Here, we describe the design and implementation of an inexpensive ESP32-based Wi-Fi repeater that incorporates rule-based firewall configuration, traffic visualization, client termination mechanisms, and DoS/DDoS security. The suggested solution makes use of the ESP32's embedded web server, local storage (LittleFS), and networking stack to produce a thin cybersecurity dashboard that managers may view. The system successfully logs client behavior, enforces traffic rules, and guards against simple DoS assaults, according to experimental data. However, the necessity to switch to a more scalable Raspberry Pi-based system with support for Suricata IDS, advanced traffic filtering, and machine learning-based anomaly detection is highlighted by processing power and memory constraints. This study lays the groundwork for future routers that are mindful of cybersecurity and offers a workable paradigm for incorporating security into IoT networking environments.

An Analytical Study of Cybersecurity Preparedness in Cooperative Banks of Satara, Sangli, and Kolhapur Districts: A Literature Review

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Abstract:

This comprehensive review paper systematically examines the state of cybersecurity preparedness in cooperative banks across the Satara, Sangli, and Kolhapur districts of Maharashtra, India. As vital financial institutions serving rural and semi-urban populations, cooperative banks face escalating cyber threats while grappling with resource constraints, outdated infrastructure, and fragmented regulatory oversight. Through an analysis of 50 scholarly articles, regulatory documents, and case studies from 2010-2023, this study reveals critical vulnerabilities including inadequate encryption (80% of Satara banks), insufficient employee training (absent in 60% of institutions), and poor compliance with RBI guidelines (only 35% adherence). The paper highlights significant regional incidents such as the 2018 Cosmos Bank heist (₹94 crore loss) and 2022 Sangli ransomware attacks, while comparing local challenges against global cybersecurity frameworks like NIST and GDPR. Key findings demonstrate that 78% of studied banks lack intrusion detection systems and 73% operate without multi-factor authentication. The study proposes a three-tiered intervention strategy: (1) mandatory state-funded cybersecurity upgrades, (2) AI-enhanced threat detection systems tailored for resource-constrained environments, and (3) revised Maharashtra Cooperative Banking Acts to include cybersecurity audits. This research contributes to the limited academic literature on regional cooperative bank security in developing economies, offering actionable policy recommendations while identifying gaps for future studies in behavioral cybersecurity and cost-effective defense mechanisms for small financial institutions.

Keywords: Cybersecurity preparedness, Cooperative banks, financial inclusion, Maharashtra districts (or SataraSangli Kolhapur), RBI compliance, Cyber threats in banking, AI-driven threat detection

Deep Learning Approaches in Eye Tracking: Applications for Mouse Cursor Movement and Automated Clicking

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Abstract:

Eye gaze tracking has emerged as a promising technology for hands-free human–computer interaction, especially in applications requiring accessibility and adaptive control. This project presents a deep learning–based framework for automatic cursor movement and mouse click operations through real-time eye tracking. The system captures live video frames from a webcam and applies convolutional neural networks (CNNs) for detecting and localizing eyes with bounding boxes. Centroid calculation techniques are then employed to determine the precise gaze direction, which is subsequently mapped to screen coordinates for cursor positioning. By translating eye motion into equivalent cursor movement, the model enables seamless computer control without the need for physical input devices. An intelligent blink detection mechanism is integrated to simulate mouse click actions, further extending the system’s usability. The architecture is designed to achieve robustness under varying lighting conditions, facial orientations, and occlusions, ensuring stable cursor movements. The approach is lightweight enough to run on standard computing hardware while maintaining high responsiveness. Experimental results indicate smooth cursor navigation and reliable click simulation, making it suitable for accessibility tools, gaming interfaces, and virtual reality applications. The framework combines the strengths of computer vision, deep learning, and human–computer interaction paradigms to create a practical alternative to traditional input devices. Beyond accessibility, this research opens pathways for innovative applications in smart environments, assistive technology for differently abled individuals, and gesture-free computing systems. Overall, the proposed system represents a step toward natural, intelligent, and inclusive user interfaces, demonstrating the potential of eye gaze tracking as a powerful modality for future human–machine collaboration.

Keywords: Eye Tracking, Gaze Estimation, Human–Computer Interaction, Deep Learning, CNN, Centroid Calculation, Computer Vision, Blink Detection, Real-Time Processing, Gaze Based Interfaces, Feature Extraction, Eye Movement Detection.

A Comprehensive Review of Blockchain Frameworks for Secure Banking Transactions Using Hashing and Cryptographic Signatures

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Abstract:

Blockchain technology has become a key solution for secure financial transactions, offering transparency and immutability. Yet, rising cyber threats and the demand for high value banking security call for stronger hashing and encryption methods. This project introduces an advanced blockchain framework that integrates SHA-256 hashing with public-private key cryptography and a re-hashing step. First, transaction data is hashed with SHA-256 to generate a digital fingerprint. Next, this hash is encrypted using asymmetric keys for authenticity and non-repudiation. Finally, the encrypted data undergoes another SHA-256 hashing to produce the block hash, ensuring tamper resistance. Unlike conventional blockchains designed for cryptocurrency mining, this system is optimized for banking, where correctness and trust are critical. The layered hashing and signature process ensures that only valid entities can authorize transactions, while unauthorized changes are immediately detectable. The design supports compliance with financial regulations and protects against replay and man-in-the-middle attacks. Additionally, the method maintains scalability by keeping cryptographic overhead manageable. Overall, the system provides a secure, verifiable, and regulation-ready blockchain model for next-generation digital banking.

Keywords: Blockchain, Banking Security, SHA-256, Public Key, Private Key, Digital Signature, Cryptography, Multi-layered Hashing, Financial Transactions, Data Integrity, Asymmetric Encryption, Hash Function, Block Hash, Cybersecurity.

Deep Learning Approach for Blood group Prediction from Fingerprint Patterns

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Abstract:

Rapid and reliable identification of blood groups is crucial in healthcare, but conventional testing is invasive and inaccessible in rural settings. This paper shows a non-invasive method based on fingerprint images and deep learning. A Convolutional Neural Network (CNN) was trained on 8,000 fingerprint samples covering eight blood groups, with preprocessing and augmentation for consistency. The model had 87.94% validation accuracy, exhibiting excellent generalization with minimal mistakes across similar groups. To facilitate practical application, a cloud-based Android app was built whereby users could scan their fingerprints and receive instant predictions. The research proves that CNNs can serve as a feasible and effective alternative to traditional techniques, with applications in healthcare, forensic science, and biometric systems.

Deepfake Recognition Using Artificial Intelligence

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Abstract:

Deep fakes are AI-generated media that convincingly alter videos, images, or audio, posing risks to privacy, security, and public trust. This work presents an AI-based framework for detecting such manipulations using CNNs and transformers to identify visual and audio inconsistencies. A multi-modal approach enhances accuracy by analyzing both streams together. The system offers practical applications in social media monitoring, digital forensics, law enforcement, and content verification, helping preserve the reliability of digital information.

Keywords: Deepfake Detection, Artificial Intelligence, Convolutional Neural Networks (CNN), Transformers, Multi-Modal Analysis, Explainable AI (XAI), Generative Models, Synthetic Media

Adaptive Voice-Controlled PC Assistant

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Abstract:

This research paper presents the design and implementation of an Adaptive Voice-Controlled PC Assistant, a system that enables users to interact with their personal computers through natural voice commands. By integrating technologies such as Speech Recognition, Natural Language Processing (NLP), and Text-to-Speech (TTS), the assistant allows hands-free execution of tasks like opening applications, retrieving information, checking weather updates, sending emails, and automating routine PC functions. The proposed system significantly enhances accessibility for physically challenged users and improves productivity for general users. The methodology includes the use of Python programming and APIs such as WolframAlpha, Wikipedia, and News API. The results demonstrate accurate task execution and user-friendly interaction, with a future scope for offline support and multilingual capabilities.

Keywords: Adaptive Voice Control, Voice Recognition, Speech-to-Text, Natural Language Processing (NLP), User Interface (UI), Machine Learning, Speech Synthesis (Text-to-Speech), Command Customization, Assistive AI, Audio Processing.

ShuffleNet V2 vs. MobileNet V2: A Benchmarking Study on Computational Efficiency and Accuracy in Transfer Learning

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Abstract:

The problems of limited data availability and massive computational costs of training deep neural networks from scratch have been successfully tackled by transfer learning (TL). TL has become a dominant and transformative paradigm in deep learning of late. This review presents a detailed account of the status of transfer learning methods and applications for image classification. We summarize findings from a growing literature to clarify the underlying principles of TL, such as feature extraction and fine-tuning approaches, and how they apply to various convolutional neural network (CNN) architectures—such as; VGG, ResNet, EfficientNet, and MobileNet. We highlight specific applications, especially in medicine—like COVID-19 pneumonia classification and diabetic retinopathy classification—where TL has produced diagnostic-level accuracies (>95%) and other domains such as agricultural product classifications, garbage sorting and remote sensing imagery classification. In order to demonstrate the practical implications and trade-offs of lightweight architectures, we present a comparative case study of nail disease classification that found ShuffleNet V2 outperformed MobileNet V2 (82% accuracy) as well as being more computationally light. In addition to the technical building blocks of TL, we also discuss some of the technical problems of TL such as negative transfer, domain shift and class imbalance. We also discuss optimization strategies such as data augmentation and hyperparameter tuning.

Keywords: Transfer Learning, Deep Learning, Image Classification, Convolutional Neural Networks (CNNs), Fine-tuning, Medical Imaging, Domain Adaptation.

Literature Review: Optimal Cloud Utilization and Threat Analysis in Mobile Environments with Reference to Satara District

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Abstract:

In mobile environments, cloud computing presents revolutionary possibilities for cost-effectiveness, scalability, and data accessibility, especially in areas with limited resources like India's Satara District. This review examines optimization techniques that show notable gains in latency, energy efficiency, and utilization rates, such as edge computing, containerization, and machine learning-based resource allocation. However, significant obstacles still exist that prevent smooth adoption, including erratic electricity supplies, inadequate last-mile connectivity, and antiquated devices. The dangers of mobile-cloud integration are increased by security risks such as phishing, insecure APIs, and man-in-the-middle attacks. With quantifiable decreases in unwanted access, mitigation frameworks like Zero Trust Architecture and blockchain-based authentication have demonstrated promise. When localized solutions are used, mobile-cloud systems have the potential to improve socioeconomic outcomes, as demonstrated by case studies on governance, healthcare, education, and agriculture. Region-specific models are required for inclusive and sustainable rural cloud transformation because, despite achievements, there are still gaps in offline-first architecture, policy support, and socio-technical adaptation.

Keywords: Cloud Computing, Mobile Environments, Threat Analysis, Edge Computing, Satara District, Zero Trust Architecture, Blockchain Authentication, Rural Digital Transformation.

Unsupervised Anomaly Detection for Predictive Maintenance of PMDC Motors Using Multi-Sensor Fusion and Machine Learning.

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Abstract:

This paper presents an unsupervised learning framework for detecting anomalies in Permanent Magnet DC (PMDC) motors using sensor-fusion data and machine learning algorithms. The researchers used the complete F.A.I.R. Brushed DC Motor Faults Dataset, which includes vibration, sound, temperature, current, and voltage in its multi-sensory data. The algorithms of interest were rigorously compared for their ability to detect anomalies via three different strategies: the tree-based Isolation Forest, the proximity-based Local Outlier Factor (LOF), and a deep learning Autoencoder, which were selected for their capacity to model complicated patterns without supervision. The outputs from the models were used to create an ensemble for a new, strong, ranked anomaly score. The approach proved to be very successful in discovering subtle abnormal operating states. The analysis of feature contribution values, facilitated by heatmap visualizations, determined that variation in vibration and current were the most indicative of faults, likely symptoms of underlying issues such as mechanical imbalance and electrical disturbances. Most importantly, the results indicate that unsupervised methods can effectively identify early-stage incipient motor faults without pre-labeled fault data. This research represents a significant opportunity to enable cost-effective predictive maintenance for industrial applications, allowing for remedial action to be taken before catastrophic failures occur.

Keywords: Predictive Maintenance, Anomaly Detection, PMDC Motor, Isolation Forest, Autoencoder, Local Outlier Factor, Machine Learning, Unsupervised Learning.

Wearable Smart Blind Shoes: An IoT-Enabled Edge Based Assistive Solution

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Abstract:

Navigating independently is a severe challenge for the visually impaired. In this paper, we described the design of a smart shoe architecture with the Internet of Things (IoT) and edge computing to create a fully integrated hands-free mobility aid. The architecture featured a multi-modal sensor framework to detect obstacles and water hazards while providing real-time audio feedback through voice commands or a buzzer. The architecture included a GPS location tracking and GSM-based emergency communication system that can send a location-tagged SMS message wherever the user is to pre-defined contacts, and can also place an automatic call whenever the user initiates an emergency via a wireless remote module. In addition, the system supports a buzzer alert for locating the shoe in case it has been put down and separated from the user's attention. The architecture leverages a distributed edgecomputing approach through the use of an Arduino Nano processor for sensors and audio feedback as well as an ESP32 module for Internet connectivity in order to provide low latency and high reliability. There are other works in TAC with IoT-based mobility aids for visually impaired, but our work is unique based on our wireless handheld remote controller and fully robust IoT + safety functionality that combined obstacle + water detection, emergency communication, and device tracking on one user-focused platform to enhance mobility and safety for the visually impaired.

Keywords: Assistive Technology, Visually Impaired, Obstacle Detection, Internet of Things (IoT) Edge Computing, Wearable Sensors, GPS Tracking, Emergency Alert System.

Prediction of Diabetic Retinopathy using Deep Learning Techniques

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Abstract:

DR, a condition linked to diabetes, can seriously impair vision if treatment is not received. In order to assess retinal fundus pictures for the early diagnosis and categorization of DR, this study uses deep learning algorithms. CNN, which is utilized to extract spatial characteristics from retinal pictures and categorize them into suitable DR phases, are the only foundation of the suggested model. The accuracy of the model is 85.01% using the APTOS 2019 dataset and other publicly accessible datasets. Through comparison with different basic designs, the CNN model's resilience is illustrated. This method helps physicians choose efficient treatment plans to lower the risk of visual loss and facilitates prompt identification of DR.

Keywords: DR, CNN, Deep Learning.

Advances in Deep Learning and Hybrid Neural Networks for Leukemia Diagnosis: A Review

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Abstract:

The most common pediatric hematological malignancy is Acute Lymphoblastic Leukemia (ALL) and there are about 6,500 new cases diagnosed each year in the United States. Conventional diagnostic methods are based on manual microscopic analysis, which is laborious, subjective and liable to human error. The current review is a systematic analysis of recent trends in deep learning-based system of ALL detection between 2018 and 2025, covering methodologies, datasets, performance metrics, and comparative analysis of different architectural designs. We reviewed 100+ state-of-the-art publications that applied CNNs, transfer learning, attention maps, and hybrid networks to detect ALL in bone marrow and peripheral blood smear images. Recent methods have impressive accuracies of 91.98 to 99.86, with 99.25 accuracy with VGG19 with Multi-Head Self-Attention. The problems with the critical research gaps are data standardization, dealing with class imbalance, and interpretability. This review positions Parallel Orthogonal Deep Neural Networks (PODNNs) and Binary Deep Neural Networks (BDNNs) as promising emerging solutions to address computational efficiency and ensemble diversity challenges. PODNNs leverage enforced orthogonality constraints to maximize model diversity while maintaining computational efficiency, while BDNNs offer significant computational advantages through weight quantization without substantial accuracy degradation. Our analysis suggests these approaches could achieve superior performance with reduced computational overhead, making ALL detection more accessible in resource constrained clinical environments.

Keywords: Acute Lymphoblastic Leukemia, Deep Learning, Convolutional Neural Networks, Medical Image Analysis, Computer-Aided Diagnosis, Transfer Learning, Attention Mechanisms

Plant Disease Detection Using CNN

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Abstract: Plant diseases can harm crops and reduce food production. Traditional ways of spotting these diseases can be slow and require experts. In this project, we use a deep learning method called Convolutional Neural Networks (CNN) to automatically detect plant diseases. The system works by analyzing pictures of plant leaves, identifying healthy leaves from diseased ones. It can recognize different diseases by looking at changes in color, texture, and shape in the images. This method is faster, more accurate, and doesn't need expert knowledge. It can be used with mobile apps or drones for quick, real-time disease detection, helping farmers manage crops more effectively. The results show that CNN is a promising solution for improving plant disease detection. This project focuses on developing a plant detection system using deep learning techniques to improve agricultural efficiency. By employing Detectron2, an advanced object detection framework, the system aims to accurately identify and classify various plant species in real-time, facilitating better monitoring of plant health and resource management. Plant sicknesses have an effect on the boom in their respective species, consequently their early identity is very important. Many gadgets getting to know (ML) fashions had been employed for the detection and type of plant illnesses however, after the advancements in a subset of ML, that is, Deep learning (DL), this location of studies appears to have super ability in phrases of improved accuracy. Many developed/modified DL architectures are implemented along with numerous visualization techniques to stumble on and classify the signs of plant sicknesses.

Keywords: Plant Disease Detection, Convolutional Neural Networks (CNN), Plant Health Monitoring.

Machine Learning Approaches for Cardiovascular Disease Risk Prediction in the Post COVID 19 Vaccination Era: A Systematic Review

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Abstract: Cardiovascular diseases (CVDs) remain the leading cause of death worldwide and continue to pose an enormous public health burden. Traditional risk calculators often fail to capture the complex, nonlinear relationships between diverse clinical variables and emerging risk factors such as vaccine associated inflammatory events. Advances in machine learning (ML) have enabled sophisticated models to extract patterns from electronic health records, imaging data and bio-signals and have shown accuracies between 82% and 97% in predicting CVD risk across various populations. The widespread roll out of COVID 19 vaccination programs has led to very rare but noteworthy cardiovascular complications, including myocarditis and pericarditis, particularly in younger males. These events necessitate careful integration of vaccination related variables into ML based risk prediction frameworks. This review synthesizes recent literature on traditional and advanced ML algorithms for CVD risk prediction, emphasizes the epidemiology and clinical presentation of post vaccination cardiovascular events, and discusses challenges and future directions for deploying ML models in clinical practice.

Keywords: Cardiovascular Diseases (CVDs), Machine Learning (ML), risk prediction, COVID-19 vaccination, myocarditis, pericarditis

IoT-Enabled Rover for Bomb Diffusion Applications

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Abstract:

This report presents the design of an IoT-enabled bomb disposal rover aimed at improving safety and efficiency in Explosive Ordnance Disposal (EOD) missions. Unlike traditional methods that risk human lives, the rover uses robotics to handle dangerous tasks from a safe distance. A Raspberry Pi serves as the main controller, managing live video streaming, remote communication, and system coordination, while lightweight microcontrollers support motor and sensor control. The rover features a durable aluminum body, a multi-joint robotic arm for precise handling, and a sensor suite. A web-based interface ensures real-time operation, with future possibilities including autonomous navigation and 3D sensing.

Keywords: Raspberry pi, Robotic Arm, IOT, Camera, Remote Operating, Real Time Monitoring.

Advancing PCB Quality Control with YOLOv8-Based Defect Detection

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Abstract:

A Printed Circuit Board (PCB) is one of the most important components in any electronic system, and even small manufacturing defects can cause major failures in device functionality. Ensuring the reliability of PCBs during production is therefore a critical task. Traditional inspection techniques, however, are still largely manual, requiring significant human effort and time while often being prone to mistakes. These methods also struggle to provide accurate verification of circuit connectivity in complex designs. To address these challenges, this paper introduces a hybrid inspection approach that combines deep learning with graph-theoretic analysis. The YOLOv8 algorithm is trained on the DeepPCB dataset to automatically detect common PCB defects such as open circuits, short circuits, mouse bites, spurs, pinholes, and spurious copper. For cases involving open circuits, where connectivity is interrupted, a graph-based method using NetworkX is applied to explore alternate electrical paths through breadth-first search. This ensures not only defect detection but also circuit evaluation. Furthermore, a user-friendly interface is developed with Gradio to make the system accessible and easy to use. Experimental evaluation shows promising results, achieving 90% accuracy in defect detection and 85% success in identifying alternate paths, proving the effectiveness of the proposed system for both industrial and academic applications.

Keywords: PCB Defect Detection, YOLOv8, Graph Theory, Open Circuit, Gradio, Deep Learning

Oil Spill Detection on Sea Using RADAR Technology

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Abstract:

This study explores the effective utilization of RADAR technology for the detection of oil spills on the ocean's surface. Oil spills present a significant threat to the environment and marine life, making it essential to identify them swiftly and accurately to reduce ecological damage. RADAR functions by transmitting microwave signals and proves particularly useful in monitoring large sea areas under adverse weather conditions such as cloudy skies or darkness, where traditional optical methods are ineffective. The research focuses on how oil spills alter the interaction of RADAR waves with the ocean surface, producing distinct patterns that are clearly visible in RADAR imagery. To improve the visibility of these patterns, the study applies techniques like contrast enhancement and precise boundary setting to distinguish oil-polluted areas from clean water. The findings indicate that RADAR technology can reliably detect oil spills, offering critical real-time data to environmental response teams. This method is not only cost-effective but also supports early detection, efficient response planning, and improved protection of marine ecosystems. Overall, the study underscores RADAR as an essential tool in managing and mitigating pollution in ocean environments.

Keywords: Oil spill detection, RADAR technology, sea surface monitoring, remote sensing, surface roughness, remote sensing imagery, spill response, microwave signals, ocean surveillance.

Towards Patient-Centered Care: Machine Learning Approaches for Holistic Multi-Disease Diagnostics

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Abstract:

Rising incidence of multimorbidity requires multimorbidity healthcare systems that can diagnose all diseases at one time. This review has tried to integrate existing evidence on multi-disease diagnosis systems based on machine learning, keeping in mind data integration, methodology innovation, and feature engineering approaches. Search was performed on prominent databases with direct search terms, and 30 studies from 2011 to 2024 were included after applying direct inclusion and exclusion criteria. The research revealed that multimodal learning, ensemble methods, and deep neural networks significantly enhanced the accuracy of diagnoses in all fields, while new feature engineering methods provided higher interpretability and efficiency. Yet, issues regarding transparency, generalizability, and ethical use remain. Overall, multi-disease diagnosis systems enabled by AI are very promising to push patient-centered care, given that subsequent work achieves a tradeoff between performance and interpretability and clinical trust.

Keywords: Multi-Disease Diagnostics · Machine learning · Deep learning · Artificial Intelligence

Performance analysis of Custom Dataset using CNN Model for Real Time Facial Emotion Recognition

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Abstract : Facial Emotion Recognition (FER) has emerged as a critical area in computer vision, with applications spanning human-computer interaction, surveillance, and affective computing. This study evaluates the performance of a Convolutional Neural Network (CNN) model on a custom facial image dataset, focusing on the influence of varying lighting conditions and image resolutions. At the initial training stages, all configurations exhibited low accuracy (15–17%) with high loss values, indicating a uniform baseline. As training progressed, substantial improvements were observed, particularly under medium light conditions, which provided faster convergence and more stable performance. Notably, at a lower resolution of 48px, medium light achieved the highest final accuracy of 99.44%, outperforming bright light, which reached 91.19% under the same setting. In contrast, higher resolution images (216px) favored bright light, yielding a final accuracy of 98.56% compared to 96.23% under medium light. Validation accuracy trends closely followed training performance, demonstrating consistent improvement across epochs. Medium light conditions generally produced more reliable and stable results, particularly at lower resolutions, while bright light proved advantageous at higher resolutions after extended training. These findings highlight the significant impact of environmental and resolution factors on FER performance and underscore the adaptability of CNN-based models for real-world.

Keywords: Convolutional Neural Network (CNN), Custom dataset, Facial Emotion Recognition.

IOT Based Intelligent Wheelchair

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Abstract :

People suffering from mobility impairment often rely on manual or powered wheel-chairs, which may not be affordable or practical for the severely impaired. To overcome these limitations, this project proposes an IoT based intelligent wheel-chair that aims at improving safety, mobility and independence at an affordable price. An integrated system of the Node MCU microcontroller, ultrasonic sensors (for obstacle clear), NEO-6M GPS module (for real-time tracking) and Blynk IoT platform (for mobile-based remote control) are used. Experimental results show that the wheelchair proves to be able to stop on the presence of obstacles, give accurate updates of its location with GPS data, and responds reliably to commands through a smartphone application. The results validate that the prototype works, is affordable and user-friendly, and could be a viable solution for middle- and low-income users. This work not only raises awareness of the potential of assistive technology enabled by IoT but also lays the foundation for future improvements such as voice or gesture-based interfaces, sophisticated navigation and integrated healthcare monitoring.

Keywords: Disability Support, GPS Tracking, IoT, Obstacle Detection, Smart Wheelchair

Autonomous Robotic Systems for Fall Armyworm Detection and Eradication

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Abstract:

A significant risk to rural yields all through the world is the Fall Armyworm's (FAW) quick overall extension. The objective of this undertaking is to create and test an original mechanical framework that can recognize the FAW bug executioner stage all alone and obliterate it utilizing Web of Things (IoT) and licensed innovation (IP) advancements. Objectives recorded in the proposition incorporate concentrating on what FAW means for farming yields, fostering a mechanical framework that utilizes robots to distinguish and obliterate vermin, and utilizing the Web of Things and protected innovation to manage energy utilization and flight ways. Utilizing another calculation, swarm drone control, serious areas of strength for and frameworks and the strategy adopts a non-substance strategy. Procurement of bug pictures, pre-handling, edge discovery, shape include extraction, distinguishing proof of bugs, and annihilation techniques are the principal parts of the framework. Issues like utilizing complex sensor exhibits and AI strategies to find bugs hid underneath leaves are additionally shrouded in the exploration. The objective is to foster a mechanical framework that can rapidly distinguish and obliterate FAW without utilizing synthetics. This framework will assist with bother control in agribusiness.

Keywords: Fall Armyworm, Robotic System, IoT and IP Technologies, Autonomous Drone, Pest Management, Machine Learning.

Energy Conservation in Mobile WSNs through PSO-Based Multihop Clustering and Sleep Scheduling

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Abstract:

This paper presents a novel and intelligent clustering framework for Wireless Sensor Networks (WSNs) that combines Particle Swarm Optimization (PSO), energy-aware multihop routing, sleep scheduling, and mobility-enabled node repositioning to enhance network efficiency, lifetime, and reliability. Conventional WSN protocols often encounter challenges such as uneven energy consumption, coverage gaps, and early node failures, particularly in heterogeneous network deployments. To address these limitations, we introduce a subset of movable sensor nodes that dynamically reposition themselves based on network density, residual energy, and coverage requirements, thereby maintaining consistent connectivity and balanced energy distribution. PSO is applied to optimize cluster head (CH) selection and relay path formation, ensuring minimal energy expenditure while maximizing communication efficiency. In parallel, sleep scheduling techniques are implemented to further conserve node energy and extend operational lifespan. Extensive simulation studies demonstrate that the proposed approach significantly outperforms traditional PSO-only and static clustering schemes, achieving up to 80% more alive nodes at the end of 3000 rounds, while improving network coverage, load balancing, and overall reliability in dynamic WSN environments.

Keywords: Wireless Sensor Networks (WSNs), Particle Swarm Optimization (PSO), Multihop Routing, Sleep Scheduling, Mobile Sensor Nodes, Cluster Head, Network Lifetime, Latency Reduction, Energy-Aware Clustering

Multi-Disease Classification in Crops Using Multi-Modal Leaf Image Fusion and Attention Mechanisms

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Abstract:

Identifying, diagnosing, and treating crop diseases as early as possible is of utmost importance in agriculture, particularly for ensuring food security and productivity. Manual disease observation is tedious, subjective, and often impractical. Recent advances in deep learning have enabled automated disease detection, but most conventional methods relying on single-modal images struggle to capture the full range of disease symptoms. In this work, we propose a novel framework for multi-disease classification in crops such as tomato, wheat, grapevine, and strawberry by combining multi-modal leaf image fusion with attention mechanisms to enhance feature representation and classification performance. The system integrates information from RGB, hyperspectral, and thermal images to capture complementary visual and physiological characteristics of diseased leaves. An attention mechanism is further employed to highlight disease-specific regions while suppressing irrelevant background noise. Experimental validation on benchmark datasets demonstrates that the proposed framework achieves superior accuracy, precision, and recall compared to conventional single-modal CNN models. The results highlight the effectiveness of image fusion and attention in addressing complex disease scenarios. This study provides a promising direction for developing intelligent, scalable, and real-time solutions in precision agriculture to support farmers with timely disease diagnosis and crop management.

Keywords: Crop disease classification, Multi-modal image fusion, Attention mechanism, Deep learning, Precision agriculture, Leaf image analysis.

Machine Learning Based Boiler Health Monitoring System Using IoT

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Abstract:

Boilers play a critical role in industrial operations and thermal power generation, where uninterrupted performance and safety are of utmost importance. Traditional monitoring methods rely on manual supervision of parameters such as temperature, pressure, humidity, gas leakage, and water level, which increases the risk of accidents and operational failures. To address these challenges, this work proposes a machine learning-based boiler health monitoring system integrated with the Internet of Things (IoT). The system utilizes sensors—including temperature, humidity, water level, vibration, and gas concentration—that are interfaced with microcontrollers such as ESP8266/ESP32. Real-time data is transmitted to cloud platforms via Wi-Fi, where it is analyzed using machine learning algorithms to predict potential faults, detect anomalies, and classify risk levels. This predictive capability enables timely decision-making, reduces human intervention, and enhances overall safety. The proposed system not only provides continuous monitoring and visualization through IoT dashboards but also improves reliability by integrating intelligent fault prediction, making it a scalable and cost-effective solution for modern industrial boiler management.

Keywords: Boiler health monitoring, Internet of Things (IoT), Machine learning, Predictive maintenance, Industrial safety, ESP8266, Real-time monitoring, Fault detection.

IoT-Integrated Multi-Sensor Robot for 360° Surveillance and Security

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Abstract:

With the rapid advancements in electronics and communication technologies, the demand for intelligent, real-time security solutions has become more critical than ever in today's interconnected world. The system integrates various components including a Raspberry Pi 4 Model B, camera sensor, DC motor, sound sensor, and motor driver module, power supply with a buck converter, toggle button, monitor, and a Wi-Fi module. The Raspberry Pi 4 is driven by its high processing power, multi-functional GPIO pins, and versatility, making it ideal for handling complex tasks such as real-time image processing, motion control, and advanced IoT applications. The robot is capable of moving in all directions—forward, backward, left, right, and even performing 360-degree rotations with DC motors and the motor driver. The wireless camera captures real-time images and transmits them over a Wi-Fi connection. The sound sensor detects acoustic signals from the environment, while the PIR sensor identifies human presence based on body heat and motion. All components are integrated into a unified system that communicates over the Internet, enhancing the capability to monitor and control the robot remotely. This IoT-based smart surveillance and motion tracking robot can be applied in home automation, security systems, and remote monitoring, offering a flexible, cost-effective, and scalable solution.

Keywords: Internet of Things (IoT), surveillance robot, Raspberry Pi 4, Real-Time Surveillance, Motion Detection, Sound Sensing, Remote Monitoring, Android Control, Smart Security System.

Arduino-Based Automatic Seed Sowing Robot for Precision Agriculture

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Abstract:

This research presents the development and implementation of a cost-effective, Arduino-based automatic seed sowing robot designed to enhance the accuracy, efficiency, and sustainability of modern agricultural practices. The system is equipped with a solar-powered energy module, enabling off grid functionality, and integrates an ESP32 microcontroller for wireless connectivity, allowing real-time control and monitoring via a mobile interface. Key parameters such as seed spacing, row distance, and sowing rate can be adjusted dynamically by the user. The robot utilizes a set of gear driven DC motors for movement and a custom-designed mechanical dispensing mechanism to ensure precise seed placement. Environmental and obstacle sensors are employed to enable autonomous navigation and adaptability to varying field conditions. The robot's core logic is embedded in the Arduino microcontroller, which coordinates all hardware components using a structured control algorithm. Experimental validation was conducted in controlled field environments, demonstrating consistent seed deposition with a variance of ± 2 cm and a battery life of up to 6 hours under full solar charge. The proposed system significantly reduces human labor, minimizes seed wastage, and promotes uniform crop germination. This paper also discusses implementation challenges and outlines possible enhancements such as GPS integration, AI-based decision-making, and IoT-based farm analytics. The outcomes suggest that this robot can serve as a viable solution for small to medium-sized farms seeking affordable automation under sustainable energy constraints.

Keywords: Precision Agriculture, Arduino, Seed Sowing Robot, Solar Power, ESP32, Automation, IoT.

Self-Sovereign Identity (SSI) for Agricultural Product Delivery using Blockchain

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Abstract:

The agricultural supply chain continues to struggle with major challenges such as counterfeit products, late deliveries, lack of transparency, and limited trust among stakeholders. Farmers, distributors, logistics providers, and retailers often face difficulties in verifying product authenticity and tracking shipments effectively, which directly impacts consumer confidence and market efficiency. To address these challenges, this paper proposes the integration of Blockchain-based Self-Sovereign Identity (SSI) systems into the logistics of agricultural products. SSI enables stakeholders to create, manage, and control their own secure and verifiable digital identities without dependence on centralized verification authorities. Combined with blockchain, this model ensures transparent and tamper-proof tracking of agricultural products from the farm to the end consumer. Smart contracts further automate critical processes including transaction execution, credential verification, and compliance checks, thereby minimizing human intervention and operational inefficiencies. Sensitive information is protected through cryptographic mechanisms while immutable records on the blockchain foster accountability, trust, and traceability across the entire supply chain. The proposed solution not only optimizes workflows and reduces hidden costs but also strengthens trust in the provenance and authenticity of agricultural products. This approach highlights the transformative role of blockchain-enabled SSI in building a secure, transparent, and sustainable agricultural logistics ecosystem.

Keywords: Self-Sovereign Identity (SSI), Blockchain, Agricultural Supply Chain, Product Delivery, Smart Contracts, Traceability, Decentralized Identity

A Smart Cloud-Enabled Lane Change and Drowsiness Monitoring System for Heavy Vehicles

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Abstract: India, as a rapidly developing nation, has seen a significant rise in road transportation options, but the development of vehicles has not kept pace with this growth. There is an urgent need for enhanced vehicle features, particularly for long-distance drivers such as truck operators, who face challenges like fatigue and limited awareness of their surroundings. While certain BS 6 vehicles offer advanced features like blind spot detection, speed assistance, sleepiness detection, and warning systems, these are still not widespread, with a majority of vehicles being BS 4, which lack such critical safety technologies. This study proposes a cutting-edge solution that integrates real-time driver support, including fatigue detection, blind spot recognition, and lane assistance, designed specifically for long-distance drivers. The system is based on a Raspberry Pi platform, making it cost-effective and easily integrable into existing vehicles. The primary goal of this system is to alert drivers to signs of fatigue and provide assistance in real-time, thus reducing the risk of accidents caused by tiredness or lack of awareness. By offering such features, the system aims to fill the gap in vehicle safety technologies in India, especially for truck drivers, and improve the overall safety standards on the country's roads. With this innovative technology, it is hoped that road transport infrastructure will see a significant upgrade, contributing to safer driving conditions and fewer road-related incidents.

Keywords: USB camera module, Raspberry Pi 5, Python, Capacitive Proximity Sensor, Vibrator Motor.

Smart College Navigation System

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Abstract: Navigating large college campuses is a challenge for new students, staff, and visitors which we put down to the complex layout of buildings, classrooms and offices. We've seen that traditional solutions like printed maps and notice boards are passe, non-interactive and lack in terms of accessibility. To that we have developed the Smart College Navigation System which we present as a real time, interactive and user-friendly solution to make campus navigation a breeze. The system uses a Raspberry Pi for processing, a touch screen for interaction and QR codes to determine a user's present location. We use a shortest path algorithm which may be Dijkstra's to determine the best route which is then presented to the user via a digital map with also text-based directions. Also we have that the system puts out voice which is a support feature for the blind users which in turn promotes inclusivity and access. Also we see that the admins have a interface from which dynamic updates can be given out about the room availabilities, events, and also we have the issue of short term closures, all which we present to the users in real time. We have a design which is very much a growth oriented one, that in the future will see us integrate a mobile application, add more languages and also include the use of IoT in our monitoring. By the combination of indoor navigation and real time campus information the Smart College Navigation System does indeed better the experience for the users, it also reduces the element of confusion and at the same time plays a role in the digital transformation of educational institutions.

Keywords: Smart Campus, Indoor Navigation, Raspberry Pi, QR Code, Dijkstra Algorithm, Accessibility.

Brain tumor segmentation using multi-scale attention U-Net with EfficientNetB4 encoder for enhanced MRI analysis

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Abstract:

Segmenting tumors from images of the human brain through MRI is one of the largest clinical diagnosis challenges in the contemporary world. FCNs models were introduced by Shelhamer et al. (2015) towards the end of 2015, they were good at that time, but they were slow and inaccurate at finding brain tumors in MRI images of the human brain and segmenting pixels to pixels. There are 7023 images having four distinct types of tumors in the selected dataset. The Encoder of U-Net has been replaced by EfficientNetB4. The single proposed hybrid model (U-Net and EfficientNetB4) is incredibly accurate and dependable when it comes to pixel-by-pixel picture segmentation. Choosing the Python language and its various modules, including keras, numpy, tensorflow, and opencv. A number of segmentation metrics, including DSC, Mean IoU, IoU, precision, recall, sensitivity and accuracy, are very useful and accurate in evaluating the proposed model. The web application will be built with assistance from Streamlit and FastApi, and later will be deployed on an AWS cloud EC2 service.

Keywords: Brain tumor, MRI segmentation, EfficientNet, U-Net, Mobile Inverted Bottleneck Convolution, Squeeze-and-Excitation, Dice similarity coefficient

Anomaly Detection in the Cloud Environment with Attack Graph Analysis Optimization Model for Intrusion Detection System Using Sensor Placement

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Abstract: Anomaly detection is the process whereby an abnormal, anomalous, or rather unusual patterns in a dataset are detected that are not of typical character. Anomalies may be severe threats to both performance and security in the context of cloud computing, where the users are offered with scalable, on demand access to shared computing re-resources and services. These anomalies can be due to cyberattack, misconfigurations, unauthorized access, or unexpected failures of the system and their existence may damage integrity, confidentiality, and availability of cloud networks. Although there has been a tremendous advancement in cloud security, the infrastructures and resources of clouds have remained a complicated puzzle to be guarded against such anomalies because of the dynamic, distributed, and large-scale character of cloud settings. Conventional methods of anomaly detection often prove inefficient to keep up with changing data patterns and emerging threats, (i.e. rule-based or statistical methods). By comparison, contemporary machine learning (ML) and deep learning (DL) systems have more robust, scalable and intelligent solutions as they can automatically learn latent patterns and extrapolate to new types of anomalies. These techniques are not only more efficient at detecting but also lessening the false positives and are, therefore, very suitable to monitor and protect the cloud networks in real-time. This paper addresses the significance of anomaly detection in cloud computing, analyzes the status existing issues, and underlines the revolutionary impact of ML and DL solutions to the security and reliability issues in future cloud computing.

Keywords: Attack Graph, Sensor Placement, AD, Optimization

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Detection and Grading of Black Rot Disease on Grape Plant by Using ANN and Fuzzy Logic

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Abstract: Research in agriculture focusing on the automatic detection of grape leaf diseases is crucial, as it can aid in overseeing extensive grape fields and promptly identifying disease symptoms on leaves. In the agricultural industry, crops often suffer damage due to diseases. Early diagnosis of these diseases allows for the protection of crops through various treatments. The cultivation of grape plants has rapidly advanced in both quality and quantity, yet pests and diseases, particularly on leaves, have impeded the quality of agricultural products. Suppose pest infestations on grape crops and leaves are not well monitored and addressed on time. In that case, the quality and yield of grape farming will decline, leading to increased poverty, food insecurity, and mortality rates. This significant impact can disrupt the economy of any nation, especially those where about 75% of the population relies on agricultural products for their livelihood and survival. A primary challenge for farmers is reducing or eliminating pest growth that affects crop yields. Pests are organisms that spread disease, cause damage, or are bothersome. Pests that frequently harm plants include aphids, fungi, beetles, thrips, flies, snails, slugs, caterpillars, and mites. These pests can cause fitful disease dawn, resulting in famine and food shortages.

Keywords: Grape leaf disease, detection, grading, pests, economy.

Automatic Identification of Potential Respondents To Subjective And Objective Questions

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Abstract: Question-and-answer (Q&A) platforms on social networking sites provide valuable opportunities for information exchange but face challenges such as classifying questions correctly and identifying suitable respondents. This paper presents a methodology that integrates Naïve Bayes-based classification with a respondent identification module to tackle these challenges. The system integrates lexical, syntactic, and contextual attributes to differentiate subjective from objective inquiries and utilizes respondent profiles, derived from previous replying patterns, to suggest the most pertinent answerers for subjective questions. Experiments were performed on datasets obtained from Twitter and Replyz.com. The suggested model attained an accuracy of 92.5%, precision of 91.8%, recall of 92.1%, and F1-score of 91.9%, surpassing baseline classifiers including Support Vector Machine (88.0% accuracy), Decision Tree (85.2%), and k-Nearest Neighbor (83.7%). The respondent identification module exhibited robust ranking performance, achieving a Precision@3 of 92.4%, Precision@5 of 94.1%, Recall@3 of 90.5%, Recall@5 of 95.3%, a Mean Reciprocal Rank (MRR) of 0.912, and a coverage of 97.8%. Qualitative metrics gives promising results with a correct respondent match of 91.0%, response diversity of 88.5% and response relevance of 90.2%. Question-and-answer (Q&A) platforms on social networking sites provide valuable opportunities for information exchange but face challenges such as classifying questions correctly and identifying suitable respondents. The framework provides benefits for community-driven platforms, customer support services and online education systems by enhancing response relevance, decreasing unanswered inquiries and promoting user engagement.

Keywords: Social Q&A, Subjectivity Classification, Naïve Bayes.

Evaluation and Interpretation of Urban Air Pollution Using Soft Computing Technique

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Abstract: MIDC areas earlier were at an outskirts from the heart of the cities. People would be isolated from the exposure of the industrial emission. Nowadays residential zones and MIDC zones have come closure to cater the need of dwelling for the rising population. There's also humongous automobile emission in Navi Mumbai due to heavy traffic load. Major air pollutants like SO₂, NO_x, PM_{2.5} and PM₁₀ are severely worsening the air quality. There is a dire need to analyse the trend of pollutants with respect to the influence on AQI. Four study areas from Navi Mumbai (Maharashtra-India) are chosen. Selected study areas have been analysed statistically. Then applied Machine Learning (ML) tools like stochastic and SVM modelling as an emerging soft computing technique. Inference of the research exhibits outnumber concentration of NO_x, PM_{2.5} and PM₁₀ pertaining to the potential threat and spike in AQI. Yearly average level of AQI from year 2025 to 2027 has been forecasted in the range of 203 to 306 for Talaja, 140-170 for Kalyan, 144-237 for Kharghar and 110-204 for Nerul respectively. The maximum annual average concentration of NO_x and PM_{2.5} will get vary above 40 µg/m³ whereas PM₁₀ will get vary above 60 µg/m³ which are beyond the safe limits. NO_x, PM_{2.5} and PM₁₀ concentration in the ambient air will reach at the level of menace followed till year 2027. Deteriorated air quality can cause severe respiratory illness and pertaining diseases to children and adults till the end of year 2027.

Keywords: Maharashtra Industrial Development Corporation, Particulate matters, Support Vector Machine

Comparative Evaluation of Deep Learning Models for Apple Fruit Disease Classification

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Abstract: Apple production underpins global horticulture and provides significant nutritional and economic benefits. Fungal and bacterial diseases such as blotch, scab and rot reduce yields and quality, costing farmers millions of dollars and contributing to the estimated 20–50 % crop losses attributed to plant pests and diseases. Early diagnosis is essential, yet traditional visual inspection is subjective and labour-intensive. Deep learning has emerged as a powerful tool for automated disease recognition. This study investigates the performance of four convolutional architectures an in-house convolutional neural network (CNN), MobileNetV2, VGG16 and EfficientNetB0 for classifying four classes of apple fruit images (blotch, rot, scab and normal) using a dataset of 3 964 images. The models were trained for 30 epochs without data augmentation, and their performance was evaluated using precision, recall, F1-score, accuracy and confusion matrices. EfficientNetB0 achieved the highest validation accuracy (97.22 %) and F1-score (0.9717), while the baseline CNN reached 82.32 % accuracy. The findings demonstrate the superiority of transfer-learning models for fruit disease classification and provide practical insights for deploying deep learning in orchard management.

Keywords: Apple disease detection, deep learning, convolutional neural

Automated Classification of Multi-Class Skin Diseases Using a DenseNet201 Deep Learning Framework

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Abstract:

Skin related disorders and diseases constitute a major global health burden, affecting roughly one-third of the world's population and often leading to substantial psychosocial distress. Early detection and precise classification of Skin related disorders are critical because delays can permit malignant conditions to progress and increase patient mortality. This paper presents an framework which can classify of nine common skin lesions using dermoscopic images. A pre-trained model example DenseNet201 is fine-tuned and coupled with fully connected layers to learn discriminative representations of lesions. Images from a publicly available dataset are resized, normalised and augmented before being split for training, validation and test sets. The proposed model achieves a test accuracy of 83.83 % and a loss of 0.8266 after 50 epochs. The results demonstrate high precision and recall for classes such as vascular lesions and dermatofibromas, while highlighting confusion between clinically similar classes such as melanoma and nevus. Comparison with recent studies shows that although state-of-the-art transformer-based models report accuracies exceeding 90%,our DenseNet-based framework provides a strong baseline for multi-class dermoscopic analysis and offers interpretability through Grad-CAM visualizations. Future work will explore data augmentation and hybrid architectures to address class imbalance and improve recognition of challenging lesions.

Keywords: Skin disease classification, dermoscopy, deep learning, DenseNet201, transfer learning, Grad-CAM etc.

Circuit-Level Improvement using Adaptive Rectifier and Matching in RF Energy Harvesting

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Abstract:

RF energy harvests energy from surrounding RF waves and convert it into useful dc power It is increasingly viewed as a sustainable approach to energies low-power applications such as IoT devices. However, the Power Conversion Efficiency (PCE) of conventional rectifier-based RF energy harvesters remains limited due to impedance mismatch and static rectifier characteristics. The PCE can be increased by using a highly efficient antenna. It can be increased by improving the rectifier efficiency and by maximizing load matching, as a mismatch with load resistance may lead to energy loss. In this paper, we propose a circuit-level improvement using an adaptive rectifier combined with adaptive impedance matching to enhance energy conversion. The adaptive rectifier dynamically adjusts its threshold characteristics, while the matching network maintains resonance across varying input power levels. Simulation is done using ADS 2022. The antenna used is 2 X 2 with a defective ground structure. The Vout and PCE obtained are 3.07 V and 94.48 % with adaptive rectifier and matching. The Vout and PCE obtained without adaptive rectifier and matching are 2.989 V and 89.312 %. This shows improvement in the Vout and PCE if we use the Adaptive Rectifier and matching in RF Energy Harvesting.

Keywords: RF energy harvesting, Adaptive Rectifier, PCE, IMN.

A Review of Techniques for Detecting Audio Copy-Move Forgery in Digital Forensics

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Abstract:

Audio copy-move forgery is a subtle yet impactful manipulation in which a segment of a recording is duplicated and relocated within the same file. Because duplicated content shares identical acoustic properties with the source, detection is far more difficult than splicing or synthetic insertions. Such tampering poses significant challenges to digital forensics, journalism, and law enforcement. Over the past decade, researchers have proposed diverse detection methods, ranging from time- and frequency-domain analysis to statistical descriptors, advanced signal processing, and deep learning. While promising, many approaches remain vulnerable to post-processing operations such as compression, re-recording, or pitch modification. This review consolidates current progress, critically examining strengths, weaknesses, and performance of traditional, advanced, and learning-based methods. We highlight open challenges including dataset scarcity, computational cost, and interpretability, and propose future directions. Finally, we emphasize hybrid approaches—integrating spectrogram analysis, graph-based modeling, and explainable AI—as a pathway toward robust, scalable, and legally reliable forensic solutions.

Keywords: Audio copy-move forgery · Audio forensics · Spectrogram analysis · Machine learning · Digital evidence authentication

Deep Learning and NLP based Dynamic Product recommendations System Using Multimodal sentiments Recognition

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Abstract:

Recommender systems are central to modern e-commerce, yet existing pipelines largely depend on monolingual, text-based reviews, overlooking rich multimodal and multilingual feedback signals. This paper presents a deep learning and natural language processing (NLP) based recommendation framework that integrates multilingual text and speech sentiment analysis into dynamic product ranking. The proposed system accepts user feedback in English, Hindi, and Marathi, collected either as typed text or spoken voice. Spoken inputs are transcribed using Whisper automatic speech recognition (ASR) and translated into English for uniform processing. Textual feedback is encoded using XLM-RoBERTa, while acoustic sentiment features are extracted with wav2vec 2.0. A gated-attention fusion mechanism combines modality-specific embeddings to produce a sentiment probability distribution, which is mapped to a 1–5 star rating. The ratings are stored in a MySQL database and integrated into a Flask-based recommendation pipeline for real-time product score updates. Experimental evaluation on a multilingual dataset of 18,000 feedback samples shows that multimodal fusion improves Macro-F1 by +5.8 points compared to text-only baselines, reduces rating prediction error by 12.3%, and yields a 4.2% increase in click-through rate during live A/B testing. The results highlight the value of multimodal sentiment integration for inclusive and adaptive e-commerce recommendation systems.

Keywords: Multimodal sentiment analysis, Recommendation systems, Deep learning, Whisper, wav2vec, XLM-R, E-commerce

A Hybrid Virtual Try-On System Using Pose Estimation and Generative AI

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Abstract:

Virtual Try-On (VTO) technologies enable users to visualize garments digitally, reducing reliance on physical fittings and improving online shopping experiences. We propose a hybrid VTO framework that combines 2D human pose estimation with text-conditioned generative models to synthesize and fit garments described by natural language prompts. The pipeline integrates image preprocessing, keypoint extraction, prompt engineering, geometric alignment via affine and thin-plate spline (TPS) warping, and perceptual blending for realistic visualization. Evaluation on a curated dataset spanning diverse poses and garment types demonstrates strong semantic alignment (CLIP scores), improved pose-fitting accuracy, and favorable user satisfaction. Extensive ablation studies quantify the contributions of pose conditioning, warping strategies, and prompt specificity. We conclude with a discussion of current limitations, ethical considerations, and future directions toward 3D-aware and real-time extensions.

Keywords: Virtual Try-On, Pose Estimation, Generative AI, Text- to-Image Synthesis, Thin-Plate Spline

DYPTAM: A Customized MOODLE Platform for Effective Teaching Learning- A Case Study

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Abstract:

In today's digital world, Smart Teacher Education uses advanced technology to improve teaching and learning. One such tool is MOODLE, an open source Learning Management System (LMS) that helps teachers track student progress and create personalized learning experiences. At D.Y. Patil School of Engineering and Management, the MOODLE-based platform DYPTAM- acronym for D.Y. Patil Tool for Academic Management, plays a key role in enhancing digital education. It offers features like virtual learning environment, customized learning paths, course building, automated assessments, multimedia interaction and interactive collaboration tools, making teaching more effective and engaging. DYPTAM allows teachers to monitor student performance in real-time, use advance grading and integrate badges to provide mobile-friendly learning, and use gamification to make lessons more interactive. It also integrates smoothly with other educational platforms like Google Classroom and Microsoft Teams. Beyond classroom teaching, DYPTAM supports professional development by offering peer collaboration tools. With its scalability, security, and customizable features, DYPTAM helps educators create engaging, student-focused, and technology-driven classrooms. This paper explores how DYPTAM is transforming teacher education, tackling digital learning challenges, and improving overall teaching effectiveness.

Keywords: DYPTAM, MOODLE, Smart Education, LMS, AI in Education, Digital Learning, Adaptive Learning Keyword, Second Keyword

Virtually Controlling Computer Using Hand Gesture

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Abstract:

Human-computer interaction (HCI) has undergone a remarkable transformation with the emergence of gesture-driven control systems, where users can communicate with digital devices through natural hand movements. This paper explores the dynamic progress of hand gesture recognition, integrating advancements in computer vision, machine learning algorithms, and sensor-based technologies. By utilizing these innovations, the proposed methods are capable of accurately interpreting and responding to gestures, thereby extending beyond the limitations of conventional input devices such as keyboards and mice. The work emphasizes the growing importance of intuitive and immersive interfaces that align with human behavior, making technology more accessible and responsive. Through the examination of contemporary approaches, the study highlights key developments in the design and implementation of gesture-based systems, focusing on their ability to enhance usability across multiple application domains. Furthermore, it identifies the broader implications of gesture interaction, including its potential role in reshaping communication, entertainment, healthcare, and assistive technologies. By presenting both the current landscape and future opportunities, this study contributes to the ongoing shift in HCI toward more natural modes of interaction. The findings underscore the transformative capacity of gesture control to enrich user experiences, while paving the way for innovative design strategies and new directions in human-machine collaboration.

Keywords: Gesture-based interaction, Human-computer interaction, Virtual control.

Real-time Construction Site Safety Management Using Deep Learning

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Abstract:

Construction sites remain hazardous due to frequent negligence to adhere with personal protective equipment (PPE) regulations. This paper proposes an advanced AI-driven safety monitoring system based on the YOLOv5 architecture to detect PPE usage in real time. The model was trained on a comprehensive dataset annotated with five classes. After training, the model achieved a mean average precision of 82.3 %, with particularly strong performance in helmet (96.0 %) and person (93.3 %) detection. Deployed via a Flask web application, the system continuously monitors construction sites, issues alerts for safety violations and logs compliance data for audit purposes. Field testing showed detection accuracies of 79–91 % across varied lighting conditions and resulted in a 34 % reduction in PPE violations and a 67 % decrease in manual inspection hours. The results demonstrate that deep learning can significantly enhance construction safety management while reducing operational costs.

Keywords: Construction safety; PPE detection; YOLOv5; deep learning; real-time monitoring; computer vision; safety compliance.

Deep Learning-Based Speech Emotion Recognition: Challenges and Opportunities in Autism Spectrum Disorder

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Abstract:

Emotion plays a central role in human communication, guiding social interaction, learning, and adaptation. For individuals with Autism Spectrum Disorder (ASD), recognizing and expressing emotions poses significant challenges, often leading to difficulties in daily communication and social functioning. Recent advances in Speech Emotion Recognition (SER) and affective computing offer promising solutions to support diagnosis, therapy, and assistive technologies for ASD. This paper reviews existing research in SER with a particular emphasis on its application for children with ASD. The survey covers state-of-the-art deep learning models such as Convolutional Neural Networks (CNNs), Long Short-Term Memory (LSTM) networks, and attention-based hybrid architectures. In addition, multimodal approaches combining speech, facial expression, and physiological signals are analyzed. The study highlights key research gaps, including the lack of representative emotional speech datasets in regional languages, cross-cultural challenges, and the need for model interpretability. Finally, future directions are discussed, emphasizing the development of robust, inclusive, and personalized SER systems capable of bridging the emotional communication gap for individuals with ASD.

Keywords: Autism Spectrum Disorder (ASD); Speech Emotion Recognition (SER); Affective Computing; Deep Learning; Human–Computer Interaction; Multimodal Emotion Recognition; Assistive Technology

Performance Evaluation of Traditional and CNN-Driven Image Steganography for Medical Chest X-Ray Data

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Abstract:

In this study we empirically evaluate classical spatial and transform-domain steganography techniques pixel value differencing (PVD), discrete cosine transform (DCT) and discrete wavelet transform (DWT) and a convolutional neural-network (CNN) autoencoder on a dataset of anonymized chest X-ray images. We measure perceptual quality using peak signal-to-noise ratio (PSNR) and structural similarity index (SSIM), extraction fidelity using bit error rate (BER) and a recovery success metric. Baseline experiments show that DWT yields the highest PSNR (≈ 62.87 dB) and lowest BER (0.03) but limited recovery success (≈ 18.05 %), whereas PVD and DCT achieve modest quality and negligible recovery. A CNN autoencoder is then trained end-to-end to jointly embed and recover a secret message; the model achieves a recovery success rate of ≈ 96 % with PSNR ≈ 27.89 dB and BER ≈ 0.0003 . The results are contrasted with recent advances in deep steganography and steganalysis, and we discuss future improvements such as combining wavelet transforms with attention mechanisms. This work underscores the trade-off between imperceptibility and recovery in medical-image steganography and demonstrates that deep learning significantly improves extraction fidelity over hand-crafted techniques.

Keywords: Image steganography; CNN autoencoder; pixel value differencing; discrete wavelet transform; chest X-ray; PSNR etc.

Real-Time Monitoring of Carbon Monoxide Emissions and Engine Temperature in Vehicles

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Abstract:

Air pollution has emerged as one of the most pressing environmental challenges, particularly in urban areas where the transportation sector contributes significantly to deteriorating air quality. Among various pollutants, carbon monoxide (CO) emitted by two-wheelers is a major concern due to its harmful effects on both human health and the environment. Current Pollution Under Control (PUC) systems are limited to periodic inspections, offering no mechanism for real-time monitoring or enforcement. As a result, vehicles with high emission levels may continue to operate unchecked between inspections, exacerbating pollution levels. This work presents the design and implementation of a low-cost embedded system for real-time monitoring and control of vehicular CO emissions. The system employs a Winsen MQ-07 CO sensor to detect CO concentration and a temperature sensor to monitor the engine temperature, ensuring accurate readings under varying operating conditions. An STM32F103C8T6 microcontroller serves as the central processing unit, integrating sensor data and implementing relay-based control logic. When CO emissions exceed a predefined threshold, the system either delays or prevents the engine from starting, thereby compelling users to seek timely vehicle maintenance. The proposed system emphasizes scalability, affordability, and practical integration with existing two-wheeler architectures. By providing continuous monitoring, it addresses the shortcomings of conventional PUC mechanisms and introduces a proactive approach to pollution control. Beyond regulatory enforcement, the system raises user awareness of vehicle health and environmental impact, encouraging responsible usage. This approach, if widely adopted, holds potential to significantly reduce urban CO pollution, improve public health, and support sustainable transportation practices.

Keywords: Emission monitoring, Carbon monoxide sensor, STM32 microcontroller, Engine temperature, Relay control, Embedded system, Vehicle pollution.

Identification of Nutritional Deficiencies in Grape Vine Leaves through hybrid CNN and Deep Q Network Model

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Abstract:

Identification of nutrient deficiencies in grapevine leaves is essential for sustainable viticulture and increased crop yields. In this study a lightweight deep learning framework is used for identifying nutrient deficiencies in grapevines through image-based analysis. This model combines convolutional neural network (CNN) architecture and Deep Q-Network (DQN) which achieves improved feature extraction and more accurate classification. In this approach CNN helps to achieve high classification accuracy and DQN helps to achieve real-time decision support. The proposed CNN-DQN hybrid model achieved higher accuracy as compared to benchmark models. In this study a comparative analysis of proposed CNN+DQN model and five state-of-the-art transfer learning models—VGG16, Logistic Regression, Decision Tree, Random Forest and SVM is done. For the experimentation grape leaf nutrient deficient customized dataset is used containing images of four classes of deficiency Na, Mg, K and P. Here, we employed a systematic hyperparameter tuning approach. The hybridization model of CNN and DQN achieves 97.73% accuracy. For this experimentation customized dataset is used.

Keywords: Deep learning, CNN, DQN, Nutrient deficiency detection, Image classification, Agriculture

Integrated Smart Braille System for the Visually Impaired: A Systematic Review and Proposed Framework

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Abstract: Visual impairment continues to be a major global challenge, with more than 250 million people worldwide experiencing blindness or low vision, most of them live in developing regions where assistive technologies are limited. Traditional approaches such as Braille and screen readers, while valuable, have significant drawbacks: Braille conversion is costly and time intensive, literacy rates are declining and screen readers are often restricted to digital formats rather than printed or environmental text. This lack of accessible solutions forces visually impaired individuals to rely heavily on others for everyday tasks such as reading books, identifying medicine labels, or navigating unfamiliar environments, ultimately reducing their independence and quality of life. The paper presents the design of an Integrated Smart Aid for the Visually Impaired, which combines optical character recognition (OCR), AI-based scene description and solenoid-driven Braille simulation on a Raspberry Pi platform. By offering multimodal feedback—auditory, tactile and visual—the device ensures broader accessibility and adaptability. The system aims for low latency, portability, and multimodal feedback to increase independence for visually impaired users.

Keywords: Assistive Technology, Visually Impaired, Optical Character Recognition (OCR), Braille Simulation, Scene Description, Raspberry Pi, Artificial Intelligence (AI).

B-Tree Deduplication with Fingerprint Indexing

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Abstract: With the rapid and continuous growth of digital information, modern data centers are facing significant challenges in efficiently managing storage, backup, and retrieval operations. A considerable portion of stored data is redundant, particularly in repeated backups or version-controlled datasets, which leads to inflated storage costs, unnecessary write operations, and degraded system performance. This work introduces a B-tree-based deduplication framework that integrates fingerprint indexing directly within the file system layer. The proposed approach leverages a locality-aware bucket mechanism to group spatially related data blocks, thereby reducing redundant disk lookups and accelerating duplicate detection. Each data block is fingerprinted using a cryptographic hash (SHA-1), and the resulting identifiers are stored in a B-tree index, allowing for scalable, logarithmic-time lookups even in large datasets. Preliminary experiments, conducted on the Tux3 file system, demonstrate substantial improvements in storage efficiency, with up to 59% space savings for highly redundant workloads, while maintaining competitive write performance. This system's in-line deduplication ensures that duplicates are removed before they are committed to disk, reducing storage overhead and improving restore times. The design provides a transparent, application-agnostic solution well-suited for enterprise backup platforms, virtual machine storage, and cloud-based archival systems, offering a scalable and low-overhead approach to data deduplication.

Keywords: Data Deduplication · File Systems · B-Tree · Fingerprint Indexing · Storage Management

AI Powered Energy Optimaztion

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Abstract:

Energy waste in classrooms from unnecessary appliance operation is a recurring problem in educational establishments. This study suggests a smart energy optimization strategy that uses an AI camera for real-time occupancy detection and a Raspberry Pi as the central controller. The system dynamically adjusts fans, lighting, and projectors based on occupancy and environmental conditions by combining machine learning with Internet of Things-based automation. Appliances automatically turn off when no users are identified, saving power without the need for human interaction. To further improve decision-making and guarantee user comfort, additional sensors including light and temperature sensors are included. The system's cost-effectiveness and scalability were highlighted by a prototype deployment that showed notable energy savings. This strategy lowers operating costs for schools while also encouraging environmentally friendly campus infrastructure. The findings demonstrate that integrating edge computing with AI-powered vision offers a dependable and long-lasting smart classroom solution.

Keywords: Smart Classroom, Energy Optimization, Raspberry Pi, AI Camera, Automation.

GraphQL Vulnerability Scanner: A Novel Framework for Securing Modern APIs

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Abstract:

GraphQL is a data query and manipulation language that allows specifying what data is to be retrieved or modified. The language is not tied to any specific database or storage engine. Its main feature is to provide specific data which is queried. However, these features make the GraphQL vulnerable and raises many security challenges which need to be addressed. Tools like Burp Suite and OWASP ZAP provide limited support for detecting GraphQL-specific attack vectors, which result in potentially exposing the systems. In this work, we present a GraphQL Vulnerability Scanner which is designed to automatically identify critical security issues such as schema exposure, query manipulation, broken authentication, injection attacks, and excessive data retrieval. The scanner combines many modules such as automated schema analysis, dynamic fuzzing, and rule-based checks, which helps in achieving 92% vulnerability detection coverage as compared to 61% for Burp Suite and 54% for OWASP ZAP in our benchmarks. When our tool is tested against 10 open-source GraphQL APIs, our tool reported 37% fewer false negatives and 28% faster scanning times than conventional scanners. The scanner is a combination of automated schema analysis, dynamic fuzzing, and rule-based checks which help in detecting the vulnerabilities. For experimenting, we chose open-source GraphQL APIs to demonstrate the higher accuracy of our tool with reduced or fewer false negatives if compared to conventional scanners. This study demonstrates the need of specialized tools to be used in industry to secure GraphQL endpoints.

Keywords: GraphQL, API Security, Vulnerability Scanning, OWASP, Cybersecurity

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Sustainable Post-Harvest Onion Storage System for Quality Preservation

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Abstract: In India, onions are one of the most significant commercial vegetable crops and are eaten all year round. However, because it is semi-perishable, it is extremely susceptible to post harvest losses while being stored, particularly in traditional, naturally ventilated buildings that small and marginal farmers frequently employ. Extreme temperature and relative humidity changes can cause physiological weight loss, sprouting, rotting, and microbial infection. These effects can cause 30–40% of storage losses, and under unfavorable circumstances, they can surpass 50%. In addition to decreasing the amount of onions available between seasons, this degradation results in significant price swings, which hurts both growers, consumers. There are encouraging ways to reduce these losses thanks to recent developments in post-harvest management, especially in storage technology. Better onion storage systems prioritize low-cost design changes that provide ideal ventilation, humidity and temperature regulation, and defense against pests, rain. Technologies that have been demonstrated to increase the shelf life of bulbs without sacrificing quality include evaporative-cooling chambers, aerated structures, controlled modified environment storage, and enhanced curing procedures. The combination of sensors and Internet of Things-based monitoring improves storage status prediction, real-time control. Significant post-harvest losses may be avoided, a steady supply of the market could be guaranteed, farmer income could be stabilized by the creation and use of affordable, farmer friendly storage structures.

Hybrid Analytical Models for Financial Fraud Detection

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Abstract: Financial fraud continues to pose significant challenges for organizations, particularly as the volume and complexity of digital transactions grow. Conventional auditing methods and rule-based systems of ten fall short in identifying sophisticated fraudulent activities, especially in global and decentralized financial networks. To address these limitations, this study introduces a comprehensive framework that integrates traditional forensic accounting techniques with advanced computational tools. The approach combines financial ratio analysis to detect unusual liquidity and leverage patterns, digit-based methods such as Benford's Law to uncover irregularities in accounting records, and machine learning algorithms—including logistic regression, decision trees, and neural networks—for predictive detection of anomalies. Additionally, blockchain forensics are employed to trace decentralized transactions, emphasizing indicators like unusually high transaction frequency, use of mixing services, and links to known suspicious accounts. Evaluation on anonymized and simulated financial datasets demonstrates that the hybrid framework consistently outperforms individual detection methods, with neural networks providing high predictive accuracy and decision trees offering interpretable results for auditors. The study underscores the importance of pairing computational analysis with human judgment to ensure effective, transparent, and accountable fraud detection, presenting a scalable strategy for safeguarding both traditional and emerging financial systems.

Development of a Solar-Powered Multi-Motor Electric Vehicle with Intelligent Battery Management System

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Abstract:

This paper details the design and implementation of a solar-powered electric vehicle (EV) system emphasizing embedded electronics, power management, and real-time communication for efficient operation. The system utilizes photovoltaic (PV) panels for renewable energy generation and incorporates a dual-battery architecture to enhance energy storage and delivery. An ESP32-based microcontroller enables intelligent energy management and selective multi-motor control through embedded algorithms. Key features include Maximum Power Point Tracking (MPPT) for optimal solar utilization, real-time data acquisition for continuous monitoring, and a human-machine interface (HMI) that ensures transparency and user feedback. Robust communication protocols connect the battery management system (BMS), charging modules, and subsystems, supporting reliable energy flow and diagnostics. Experimental validation demonstrates improved energy efficiency, longer driving range, and higher reliability over conventional systems. Overall, the work highlights the critical role of embedded intelligence and communication technologies in advancing sustainable mobility solutions and provides a foundation for future research.

Keywords: Solar electric vehicle, embedded systems, energy management, ESP32 microcontroller, battery management system, photovoltaic integration, real-time communication.

Near-Infrared Spectroscopy Driven Embedded System for Smart Plastic Waste segregation

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Abstract:

The increasing accumulation of plastic waste poses a significant environmental challenge, necessitating efficient and automated recycling solutions. This project proposes a Near-Infrared (NIR) Spectroscopy Driven Embedded System for Smart Plastic Waste Sorting that combines advanced sensing technology with embedded intelligence to achieve accurate and rapid plastic segregation. The system employs an NIR sensor to detect the unique spectral signatures of different plastic types, such as PET, HDPE, PVC, and PP, without the need for manual intervention. The sensed data is processed by a microcontroller, which utilizes machine learning algorithms to classify the plastics in real-time. Upon classification, actuators such as pneumatic pushers or robotic arms physically separate the plastics into designated categories, enabling efficient recycling. The embedded approach ensures a compact, low-power, and cost-effective solution suitable for both small-scale and industrial recycling units. By integrating NIR spectroscopy with real-time data processing, the system enhances sorting accuracy, reduces contamination, and promotes sustainable plastic recycling. This project demonstrates a practical application of smart technologies to address environmental concerns, optimize resource recovery, and support circular economy initiatives.

Design and Simulation of AI-Based PWM Controlled Cascaded H-Bridge Multilevel Inverter for Residential Applications

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Abstract: The demand for efficient and sustainable power conversion solutions in residential applications has increased significantly due to the rapid adoption of renewable energy sources, especially solar photovoltaic (PV) systems. Conventional inverters face limitations in terms of harmonic distortion, efficiency, and scalability when integrated into residential grids. To overcome these limitations, this paper proposes an AI-based Pulse Width Modulation (PWM) controlled Cascade H-Bridge (CHB) Multilevel Inverter tailored for residential applications. The system leverages artificial intelligence techniques to optimize switching angles for minimal harmonic distortion while ensuring efficient operation under varying load and supply conditions. Simulation is carried out in MATLAB/Simulink to validate performance, focusing on parameters such as Total Harmonic Distortion (THD), efficiency, voltage waveform quality, and dynamic load adaptability. The proposed design demonstrates improved output power quality, reduced THD, higher efficiency, and compliance with IEEE standards for residential grid-connected systems.

Keywords: Cascade H-Bridge Inverter, Artificial Intelligence, PWM Control, Residential Applications, Multilevel Inverter, MATLAB Simulation

NextGen Interview Portal: An AI-Powered Virtual Recruitment System with Integrated Multi-Stage Assessment and Advanced Proctoring

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Abstract: The NextGen Interview Portal is an advanced AI-driven recruitment framework designed to modernize and secure the hiring of software engineers through an integrated online platform. It consolidates all essential stages of recruitment—resume analysis, cognitive evaluation, coding tests, and intelligent virtual interviews—within a unified, automated system. Utilizing machine learning and natural language processing, the platform interprets candidate resumes, evaluates skills, and aligns experience with job requirements, thereby minimizing manual intervention and human bias. The process encompasses an adaptive cognitive quiz, secure coding assessment, and an AI-led interview that measures communication clarity, analytical reasoning, and emotional stability through speech and facial analytics. To ensure integrity, the portal implements AI-based proctoring that monitors eye movement, facial expressions, and audio signals to detect malpractice. Additional intelligent components such as dynamic question generation, sentiment interpretation, and predictive role-matching enhance evaluation accuracy and fairness. Empirical testing demonstrates a 95.6% reduction in total hiring duration, objective and bias-free scoring, and deeper insights into candidate suitability. The NextGen system thus represents a scalable, transparent, and data-driven approach that transforms conventional recruitment into an intelligent, efficient, and equitable process.

Keywords: AI-Powered Recruitment, Multimodal, Computer Vision, Virtual Hiring Platform.

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Towards Audio Deepfake Detection for Indian Languages: Dataset Creation and Baseline Analysis

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Abstract:

With the rapid growth of artificial intelligence, speech synthesis has advanced to where computer-generated voices sound nearly identical to human speech. This progress has raised concerns about audio deepfakes, which can be exploited for misinformation, scams, and identity theft. Although deepfake detection has been widely explored for English and Chinese, research on Indian languages remains limited. This study introduces a bilingual dataset for Hindi and Marathi, created using open-source corpora such as IndicTTS and Common Voice for genuine speech, and neural TTS systems like Tacotron2 and VITS for synthetic speech. The dataset contains 4,000 samples (approximately 11 hours) balanced across gender, accent, and background noise levels. Two baseline models were evaluated: a traditional MFCC + CNN model and a modern self-supervised wav2vec2.0 model. Experimental results show that the wav2vec2.0 model achieved 96.1% accuracy with a 3.8% Equal Error Rate (EER), while the MFCC + CNN model achieved 89.4% accuracy with a 7.6% EER. Language-specific analysis revealed slightly better results for Hindi than Marathi due to richer phonetic coverage. The findings emphasize the importance of multilingual datasets and cross-language generalization for deepfake detection, promoting safer AI and improved speech forensics.

Keywords: Audio Deepfake Detection, Hindi, Marathi, MFCC, CNN, wav2vec2.0, Speech Forensics, Low-Resource Languages, Indian Dataset

Durability Performance of Concrete Incorporating Waste Glass Powder under Chloride And Sulphate Exposure

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Abstract:

The production of one tone of cement releases an equivalent amount of carbon dioxide, significantly contributing to global warming. To mitigate environmental impacts and reduce cement consumption, partial replacement of cement with pozzolanic materials is a promising strategy. While industrial by-products such as fly ash, silica fume, and ground granulated blast furnace slag have been widely used for this purpose, recent studies indicate that waste glass can also serve as an effective pozzolanic material. When finely ground, waste glass exhibits pozzolanic properties due to its high silica content, enabling its use as a partial cement replacement in concrete. This study investigates the influence of waste glass powder on the strength and durability properties of concrete, particularly its resistance to chloride and sulphate attacks and freeze thaw conditions. After 60 days of curing, test specimens were exposed to a freezing environment at -18°C for 90 days, followed by re-curing and strength testing in accordance with IS specifications. The findings highlight the potential of waste glass powder to enhance the durability and sustainability of concrete.

Keywords: Waste glass powder, Durability, Freeze-thaw resistance, Chloride attack, Sulphate attack.

A Comprehensive Review of Blockchain Frameworks for Secure Banking Transactions Using Hashing and Cryptographic Signatures

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Abstract:

Blockchain technology has become a key solution for secure financial transactions, offering transparency and immutability. Yet, rising cyber threats and the demand for high value banking security call for stronger hashing and encryption methods. This project introduces an advanced blockchain framework that integrates SHA-256 hashing with public-private key cryptography and a re-hashing step. First, transaction data is hashed with SHA-256 to generate a digital fingerprint. Next, this hash is encrypted using asymmetric keys for authenticity and non-repudiation. Finally, the encrypted data undergoes another SHA-256 hashing to produce the block hash, ensuring tamper resistance. Unlike conventional blockchains designed for cryptocurrency mining, this system is optimized for banking, where correctness and trust are critical. The layered hashing and signature process ensures that only valid entities can authorize transactions, while unauthorized changes are immediately detectable. The design supports compliance with financial regulations and protects against replay and man-in-the-middle attacks. Additionally, the method maintains scalability by keeping cryptographic overhead manageable. Overall, the system provides a secure, verifiable, and regulation-ready blockchain model for next-generation digital banking.

Keywords: Blockchain, Banking Security, SHA-256, Public Key, Private Key, Digital Signature, Cryptography, Multi-layered Hashing, Financial Transactions, Data Integrity, Asymmetric Encryption, Hash Function, Block Hash, Cybersecurity.

Miniaturized 3.5W Switch Mode Power Supply for IoT Applications

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Abstract:

This work presents the design, prototyping, and performance evaluation of a compact Switched-Mode Power Supply (SMPS) specifically optimized for Internet of Things (IoT) applications, where size and efficiency are key requirements. The converter provides a regulated 5 V DC output at 700 mA (3.5W) from a 230 V AC input, making it well-suited for embedded platforms such as ESP8266-based = wireless nodes. Traditional linear regulators, although straightforward, suffer from low efficiency and excessive heat dissipation when operating with large voltage drops, which restricts their use in sealed or thermally sensitive IoT enclosures. To address these limitations, a flyback converter topology is implemented using STMicroelectronics' VIPer22A IC, which integrates a high-voltage MOSFET with a PWM controller, minimizing component count and simplifying PCB design. The circuit was simulated using ST's VIPer IDE tool and realized on a compact 3.5 cm × 7.5 cm PCB. A custom transformer was designed to achieve proper isolation, voltage conversion, and reduced core losses. Experimental testing verified stable regulation at 5.0 ± 0.1 V across various load conditions, with an efficiency range of 85%. The prototype exhibited low output ripple <40 mV, effective thermal stability, and incorporated protection features such as overvoltage, overcurrent, and thermal shutdown. Overall, the proposed SMPS offers a cost-effective, reliable, and energy-efficient power solution designed for modern IoT devices that require a small form factor and dependable performance.

Keywords: Switched-Mode Power Supply (SMPS), Flyback Converter, VIPer22A, Internet of Things (IoT), etc.

Design and Development of a Static Wireless Charging Facility with Height Adjustment for Electric Vehicles

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Abstract:

With its safe, frictionless, and intuitive alternatives to traditional plug-in charging, wireless charging is quickly becoming a game-changer for electric cars (EVs). However, the efficiency loss brought on by coil misalignment and variations in ground clearance across various EV chassis is one of the main issues with static wireless charging systems. In order to solve this problem, this study integrates an Arduino-based control system, a servo-assisted height adjustment mechanism, and an inductive power transfer (IPT) module to design and construct a static wireless charging facility with height adjustment. Low-cost parts were used in the prototype's construction, such as IoT-enabled monitoring for real-time supervision and infrared and ultrasonic sensors for vehicle detection and clearance measurement. Reliable operation under various test conditions was proven by experimental validation. The system charged a 5V, 1000 mAh Li-ion battery in about two hours while maintaining >70% efficiency at air gaps between 2 and 10 cm, with peak efficiency of 78% at a 2 cm gap and 72% at 5 cm. Robust functioning was guaranteed by safety measures such relay-controlled switching, thermal monitoring (maximum coil temperature rise of +8 °C), and automatic cut-off at abnormal distances. The system continuously achieved constant charging performance, coil alignment (with a precision of ± 2 mm), and precise vehicle detection throughout 20 trials. This prototype contributes to the development of smart EV infrastructure by establishing a proof of concept for wireless charging stations that are scalable, intelligent, and reasonably priced.

Keywords: Wireless Charging, Inductive Power Transfer, Electric Vehicles, IoT-based Control, Charging Efficiency

Delay Analysis of Construction Projects: A Case Study in Ratnagiri District

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Abstract:

Construction delays are a significant challenge in the building sector, often leading to schedule overruns, financial disputes, and reduced project performance. This study investigates delay factors in two high-rise residential projects in Ratnagiri, India, through a structured questionnaire administered to contractors, consultants, supervisors, laborers, and owners. A total of 68 questions addressed planning, materials, labor, equipment, and external conditions. Data analysis using the Relative Importance Index (RII) revealed that insufficient planning, delays in material delivery, and communication issues are major contributors. Contractors identified poor site management and lack of modern equipment, laborers emphasized inadequate supervision and safety provisions, while consultants highlighted delayed inspections and approvals. This study underscores the importance of structured project planning, adoption of advanced construction technologies, and stakeholder coordination to mitigate delays and improve project efficiency.

Keywords: Construction Delays, Relative Importance Index, Project Scheduling, Stakeholder Management, Delay Factors

Recognition And Identification of Road Pavement Cracks through Images by using Machine Learning Algorithm

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Abstract:

The rapid expansion of urban infrastructure has amplified the challenge of maintaining road surfaces, where early detection of cracks and potholes is critical for safety and sustainability. If neglected, pavement defects accelerate deterioration, increase maintenance costs, and contribute to road accidents. Traditional inspection approaches—manual surveys or sensor-based methods—are often slow, labor-intensive, and prone to errors. With the advancement of artificial intelligence and computer vision, deep learning-based object detection offers a scalable solution for automated road monitoring. This research presents a framework for road pavement defect recognition and classification using the YOLOv8s.pt model, a state-of-the-art deep learning algorithm optimized for real-time object detection. A dataset of high-resolution pavement images was preprocessed through enhancement, normalization, and augmentation to improve robustness against varying lighting, weather, and surface textures. The YOLOv8s architecture, known for its speed and accuracy, was trained to identify cracks, potholes, and water-filled anomalies with high precision. Model evaluation was conducted using accuracy, precision, recall, and F1-score, with results showing superior performance compared to conventional inspection methods. Overall, this study demonstrates that YOLOv8-based defect detection can significantly reduce human effort, enhance road safety, and provide a scalable solution for smart transportation systems and modern infrastructure planning.

Keywords: Crack Detection, Pothole Identification, Deep Learning, YOLOv8, Object Detection, Real-Time Monitoring, Road Surface Defects, Computer Vision, Automated Road Inspection, Smart Transportation, Predictive Maintenance, Infrastructure Safety.

Self-Curing Concrete: A Review of Mechanisms, Materials, and Performance

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Abstract:

Concrete is the most widely used construction material, and its performance, durability, and service life largely depend on adequate curing. Conventional curing methods such as ponding, spraying, or wet coverings are effective but highly water intensive, labor-demanding, and sometimes impractical in remote or water-scarce regions. With the growing global concern for water conservation and sustainable construction practices, self-curing concrete (SC) has emerged as a promising and ecofriendly alternative. SC reduces or eliminates the need for external water curing by maintaining internal moisture through the use of self-curing agents such as Polyethylene Glycol (PEG), Superabsorbent Polymers (SAP), and pre-wetted lightweight aggregates. This review paper consolidates key research findings published during 2015–2025, with a focus on hydration improvement, mechanical strength, shrinkage reduction, and durability performance. Reported studies indicate compressive strength gains of 8–18%, tensile strength improvements of 7–10%, and shrinkage reduction up to 30% with PEG, SAP, mineral admixtures, fibers, and even waste-based materials. The paper also discusses challenges such as cost, dosage optimization, and the long-term behavior of different curing agents. Overall, self-curing concrete demonstrates significant potential as a sustainable innovation, particularly in arid and water deficient regions, supporting the global movement toward green construction and resource efficiency.

Keywords: Self-curing concrete, Polyethylene glycol (PEG), Superabsorbent polymers (SAP), Durability, Shrinkage reduction, Sustainable construction

Enhancing Housing Construction Quality: A Review of Six Sigma and Traditional Quality Control Integration

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Abstract:

Defects in housing construction cause significant rework, cost overruns, delays, and customer dissatisfaction. While quality management methods exist, most are reactive and fragmented, lacking housing-specific frameworks for continuous improvement. This paper addresses this gap by developing a Six Sigma Quality Control integration framework for residential construction. Using Six Sigma's DMAIC methodology, the framework identifies, analyses, and mitigates construction defects while enhancing traditional QC. Case studies demonstrate benefits, with one project reporting a 56.8% reduction in defect frequency. Related initiatives show quality cost reductions of 76% in 12 months and 92% in 36 months. Evidence indicates that defect prevention reduces rework and improves time adherence. The framework offers theoretical and practical value by aligning Six Sigma tools with QC practices, enabling projects to achieve higher quality, resident satisfaction, and sustainability.

Keywords: Six Sigma, DMAIC, Housing Construction Quality, Construction Defects

RFID and GPS Integration for Automated Bus Fare Calculation and Route Optimization

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Abstract:

Public transportation systems are increasingly adopting intelligent technologies to enhance efficiency, security, and user experience. This paper proposes an ESP32-based Smart Bus Ticketing System that integrates Radio Frequency Identification (RFID) and Global Positioning System (GPS) modules to automate fare collection, enable real-time tracking, and support route optimization. Each passenger is issued an RFID card linked to a prepaid account, while buses are equipped with entry and exit RFID scanners. When passengers tap their card, the system records boarding and alighting points using GPS data and automatically computes the distance-based fare, which is then deducted from the user's account balance. Unlike conventional ticketing approaches, the proposed system employs cloud-based data storage and live bus tracking, providing transparency, reducing human error, and enhancing commuter convenience. Additionally, the integration of location data enables transport authorities to monitor passenger flow, optimize bus schedules, and improve overall fleet management. Experimental results from the developed prototype demonstrate more than 95% RFID scan accuracy and an average fare transaction time of 2.3 seconds, achieving a 40% reduction in processing time compared to manual ticketing methods. The system is cost-effective, scalable, and eco-friendly, making it a viable solution for advancing smart urban mobility.

Keywords: RFID, Automated Fare Collection, Public Transportation, Route Optimization, Smart Card, IoT, Intelligent Transport System (ITS), Real-Time Tracking

Impact of 5S Implementation at Machine Shop: A Case Study

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Abstract:

Organizations all around the world are increasingly using lean management approaches to streamline operations, remove waste, and improve value delivery in pursuit of operational excellence and long-term productivity. Among the several lean tools available, the 5S methodology stands out as one of the most basic and extensively used methods to workplace organization and efficiency. Originally created in Japan as part of the Toyota Production System (TPS), 5S has since expanded beyond its manufacturing roots to find application in a variety of areas, including healthcare, education, logistics, construction, and office administration. The "5S" acronym stands for five Japanese words: Seiri (sort), Seiton (set in order), Seiso (shine), Seiketsu (standardize), and Shitsuke (sustain). These principles offer a structured framework for organizing the workplace, maintaining cleanliness, establishing standards, and fostering a culture of discipline and continual development. Unlike many process improvement initiatives that rely significantly on technology or capital expenditure, 5S focuses on behavioral change and employee engagement, making it both cost effective & cultural revolutionary. The importance of 5S stems not only from its ability to create visually organized and productive workspaces, but also from its wider impact on operational safety, quality assurance, employee satisfaction, and organizational culture. When effectively applied, 5S can reduce the time spent looking for equipment or materials, lower the chance of accidents, increase product quality by reducing flaws, and instill a proactive mindset in employees. However, while the 5S system appears to be simple in concept, successful implementation and long-term sustainability present significant problems. These include reluctance to change, inconsistent application across divisions, a lack of management commitment, and challenges in maintaining standards over time. As a result, organizations must not only grasp the technical stages of 5S, but also develop the leadership, training, and monitoring systems required to integrate it into the organizational fabric. This study article attempts to utilize the 5S methodology by addressing the following objectives:

1. To investigate the origins and theoretical basis of the 5S system in the context of lean manufacturing and continuous improvement.
2. To describe each of the five 5S components, including their purpose, implementation steps, and interdependencies.
3. To assess the concrete and intangible benefits of 5S deployment in diverse industries using case studies and empirical research.
4. To identify important success elements and potential problems while implementing 5S.
5. To make recommendations for achieving long-term sustainability and incorporating 5S practices into organizational culture.

By blending academic literature, industry reports, and real-world experiences, this article aims to provide a nuanced understanding of how 5S can be used to drive operational change and organizational success.

AI Driven Driveway Lane Follower with Speech Assistance

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Abstract: In recent years, the demand for affordable and intelligent driver assistance systems has increased substantially, particularly due to advancements in embedded computing platforms like the Raspberry Pi. This research outlines the design and development of a low-cost, real-time autonomous road assistant that can detect lanes, traffic signs, vehicles, and pedestrians using deep learning techniques integrated with voice feedback. The system employs a lightweight Convolutional Neural Network (CNN) model trained on a specialized traffic dataset and optimized for use with Tensor Flow Lite. By processing live video feed from an onboard camera, it identifies essential road elements while delivering context aware spoken alerts through offline text-to-speech synthesis. Designed to operate entirely on a Raspberry Pi device without requiring internet access or cloud support the system ensures reliable object detection capabilities alongside effective lane following features all achieved with minimal latency. Extensive testing confirms its potential as a practical solution suited not only toward academic purposes but also capable enough across various vehicular applications demanding constrained budgets: Its modular construction coupled together along-side full spectrum adaptability allows seamless operation even amidst diverse driving conditions signaling well-deserved consideration should anyone seek broader integration within upcoming generations concerning automatic navigation architectures in the form of portable solutions.

Keywords: Autonomous Driving, Raspberry Pi, Lane Detection, Object Detection, YOLOv5, Tensor Flow Lite, Deep Learning, Traffic Sign Recognition, Text-to-Speech, Real-Time Inference, Edge Computing, Road Safety Assistance

Productivity Enhancement of Spur Gear Machining Line through Lean Tools and Bottleneck Cycle Time Reduction

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Abstract: This paper presents a comprehensive study on productivity improvement of a spur gear machining line using lean principles and tools. The manufacturing line, initially producing 146 gears per day against a customer demand of 176 gears per day, was analyzed to identify the root causes of its lower and unstable production rate. By applying Genchi Genbutsu (Gemba Walk), Fishbone Analysis, and Standardized Work, the problems were categorized into method-related, people-related, and machine-related causes. Key interventions included optimized work sequences, strengthening 5S practices, structured tool replacement policies, and eliminating bottlenecks through cycle time reduction techniques. Significant improvements were achieved at OP30 and OP80 stations by replacing HSS reamers with carbide-tipped reamers equipped with high-pressure coolant supply. The results demonstrated a 23.28% improvement in productivity, raising the daily output to 180 gears, thus exceeding customer demand. This work provides a generalized methodology combining lean assessment with cycle time reduction strategies, delivering sustainable productivity gains, cost efficiency, and world-class manufacturing practices.

Keywords: Lean Manufacturing, Cycle Time Reduction, Spur Gear Production, Standardized Work, Kaizen

Reducing Lead Time in Sub-Assembly Levels: Analyzing and Optimizing Non-Value Added Activities at kiwi Industries

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Abstract:

Lead time reduction is a critical factor in achieving competitiveness and operational excellence in manufacturing industries. In many production systems, sub-assembly stages account for a significant portion of total lead time due to the presence of non-value- added activities (NVAAs) such as unnecessary material movement, idle time, rework, and inefficient process flows. This study focuses on analyzing and optimizing sub-assembly operations at Kiwi Industries to identify and eliminate these inefficiencies. Using Value Stream Mapping (VSM), detailed process observation, and lean manufacturing techniques, several critical bottlenecks were identified that hindered smooth workflow and timely delivery. The research implements Kaizen initiatives, 5S methodology, line balancing and standardized work procedures to streamline operations, reduce waste, and improve process synchronization. The optimized layout and workflow not only minimized redundant activities but also enhanced coordination among workstations. As a result, the study achieved a lead time reduction of approximately 28%, reflecting significant improvements in productivity, resource utilization, and operational efficiency. The findings highlight that systematic elimination of NVAAs through leanbased approaches can effectively enhance throughput, reduce costs, and improve overall customer satisfaction, providing a sustainable competitive advantage for manufacturing organizations.

Keywords: Lead time reduction, sub-assembly, non-value-added activities.

Integration of Emerging Technologies for Sustainable Development: A Review on Renewable Energy, Smart Infrastructure, and Digital Solution

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Abstract:

The Sustainable development has become an urgent global priority in response to climate change, urban expansion, and resource depletion. The convergence of renewable energy systems, smart infrastructure, and digital technologies provides a transformative pathway toward achieving the United Nations Sustainable Development Goals (SDGs). This paper critically reviews recent progress in renewable energy adoption, sustainable urban infrastructure, and digital innovations such as Artificial Intelligence (AI), Internet of Things (IoT), blockchain, and digital twins. Collectively, these technologies enhance energy efficiency, optimize resource utilization, and foster low-carbon urban environments. The review highlights cost reduction in solar and wind energy, the growing role of smart grids and green cities, and the deployment of digital solutions for predictive analytics, transparent energy trading, and infrastructure optimization. Furthermore, the paper examines policy frameworks that enable integration, while identifying challenges such as scalability, affordability, interoperability, and cybersecurity, a holistic framework is proposed to illustrate synergies across renewable system, intelligent infrastructure, and digital enablers, offering a comprehensive approach to sustained development. By addressing existing gaps through innovation, collaboration, and policy support, this study underscores the potential of integrated technological solution to accelerate progress toward global sustainability targets.

Keywords: Sustainable Development, Renewable Energy, Smart Infrastructure, Artificial Intelligence, IoT, Digital Twins, SDGs.

A Review of Artificial Intelligence Applications in Manufacturing Operations

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Abstract:

Artificial Intelligence (AI) has transitioned from isolated shop-floor deployments to enterprise-wide decision support across planning, production, quality, and service. This review synthesizes advances from roughly 2015–2025 on supervised and unsupervised machine learning, deep learning, reinforcement learning, probabilistic modeling, and hybrid approaches that enable real-time optimization, predictive quality, and autonomous control in manufacturing operations. We present a process-centric taxonomy covering design for manufacturability, process planning, scheduling and dispatching, machining and forming, additive manufacturing, robotics and human–robot collaboration, condition monitoring and predictive maintenance, in-line metrology and surface integrity, inventory and supply chain, energy and sustainability, and safety. We summarize typical data sources and pipelines, discuss model deployment (edge, cloud, and digital twins), and highlight performance metrics and reproducibility concerns. Case vignettes are provided for discrete-part machining (including difficult-to-cut alloys and EDM), assembly lines, and process industries. Finally, we outline open challenges—domain shift, small data, explainability, cyber-physical security, standards—and propose a research agenda for trustworthy, scalable, and sustainable AI in manufacturing.

Keywords: manufacturing operations; artificial intelligence; machine learning;

Productivity Enhancement in Manual Assembly Lines by Using Software: A Case Study Approach

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Abstract:

Manual assembly lines continue to be widely used in packaging and box manufacturing industries, particularly in small and medium enterprises (SMEs) where automation is often not cost-effective. These lines face persistent challenges such as unbalanced workloads, bottlenecks, idle time, and inefficient material handling. This research presents a case study from a box manufacturing company, where Lean manufacturing principles, systematic operations analysis, and simulation-based evaluation were employed to enhance productivity. Two redesigned configurations—a Single Stage Parallel Line and a Five Stage Serial Line—were compared with the original production method for mobile phone box assembly. Results indicated that the Single Stage Parallel Line delivered superior performance, achieving nearly 100% improvement in operator productivity, reducing floor space by 50%, and streamlining material flow. The study highlights the potential of software-enabled Lean redesign for significantly improving productivity in manual packaging and assembly environments.

Keywords: Box manufacturing, manual assembly line, Lean manufacturing, line balancing, simulation, productivity improvement, packaging industry

A Mini Review of Effects of textile wastewater on human health, the environment and its environmental impact assessment and management

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Abstract:

Textile wastewater contains harmful dyes and chemicals that pollute aquatic resources when discharged. The presence of these harmful dyes adversely affects the growth and reproduction of living organisms, including phytoplankton, fauna, flora, and humans, as well as the overall environment. When humans consume contaminated water that contains these toxic dyes, they can be converted into reactive intermediates, such as aromatic amines. This study aims to investigate the environmental impact of the textile industry. The manufacturing process of fabric releases toxins into the surroundings, resulting in pollution of soil, air, and water. These toxins can lead to respiratory health issues and pose significant serious threats to both humans and the ecosystem. Synthetic dyes, in particular, contain harmful chemicals, including heavy metals, sodium chloride, and benzene, which are associated with serious health problems such as cancer and skin irritation. Textile workers are particularly at risk due to their direct exposure to these toxins during the manufacturing process. To tackle textile wastewater pollution, we must employ suitable treatment technologies such as physical, chemical, biological, and combination systems. It is essential to develop efficient, economical, and environmental friendly ways for minimizing pollution discharged by textile wastewater.

Keywords: Textile wastewater, Toxic dyes, environmental impact assessment.

Passive Cell Balancing In EV Modeling Using MATLAB

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Abstract:

Cell imbalance is a major factor affecting battery system performance and lifespan. Without effective cell balancing, voltage differences between cells increase over time, causing accelerated capacity loss and premature battery pack failure. This paper reviews and compares various cell balancing topologies for battery strings through MATLAB/Simulink simulations. The comparison focuses on circuit design, balancing speed, voltage/current stress, implementation complexity, efficiency, size, cost, and application suitability, providing insights into optimal balancing strategies for enhanced battery longevity

Keywords: Cell balancing, Battery pack, MATLAB/Simulink

Investigation on Artificial Intelligence-Powered Web Interaction Bot for Enhanced and Dynamic Browsing

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Abstract:

Getting the right information quickly when a need arises through manual web navigation still seems like wishful thinking, even with the numerous improvements made to search engines and the layout of web pages. This paper showcases a solution to the dilemma of many such users who fall short on technical skills and understanding of web navigation, especially the elderly, as well as individuals with physical impairments. Recent solutions fall short in providing dynamic, context-aware automation that mimics natural human behavior on the web. As a result, our project presents the design of an AI-powered web interaction assistant that enables web navigation simply by voice commands using NLP (Natural Language Processing). The proposed system opens new possibilities for AI-powered web automation, bridging the gap between human intuition and machine intelligence. This paper aims to revolutionize how people interact with the web by utilizing state-of-the-art AI technology, making it more user-friendly and intuitive for everyone. The presented work proposes a system that uses advanced machine learning algorithms to adapt to user preferences, enhancing productivity and efficiency in online tasks, ultimately improving the overall user experience.

Keywords: Voice-based Web Navigation, Natural Language Processing, Web Automation, AI Assistant, Speech Recognition.

Performance Evaluation of SS-304 Solar Still: Experimental and ANSYS-CFD Approach

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Abstract: Water is the prime most among basic needs of human. It is a right of every individual to have an access to pure water for drinking. Availability of drinkable water on the earth is less than one percent. Numerous health issues are arising due to impure water. Sea water, which is abundantly available, can be desalinated to satisfy the drinking water requirements. Solar still is one the water purifying devices, working on hydrological cycle. The device is ecofriendly and sustainable as it use direct solar radiations as an input and delivers pure drinkable water at very low cost in comparison with other purification techniques available in the market today. This research article represents the experimental study on an innovative square shaped single sloped single effect solar still made up of SS-304. The experimental results were validated against numerical simulations conducted using ANSYS-CFD. The temperature difference between the water surface and the inner glass cover ($\Delta T = T1 - T4$) served as the key parameter for this comparison. The CFD results demonstrate good agreement with the experimental data, with percentage differences across various cases ranging from 0.22% to 20.80%. Further, volume fraction of vapor was also determined using CFD.

Keywords: Solar still, ANSYS-CFD, desalination, drinking water.

Weed Management in Indian Agriculture: Towards Automated and Sustainable Solutions

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Abstract: The successful control of undesirable vegetation, commonly known as weeding, persists as one of the most enduring and financially burdensome challenges within contemporary agriculture that seeks to avoid chemical inputs. Presently, a clear dichotomy exists in management options. While mechanized solutions have been developed to manage the inter-row spaces with relative efficiency, the critical task of removing weeds that grow in immediate proximity to crops—directly within the row—continues to depend almost exclusively on human labor. This persistent reliance on manual weeding renders the process prohibitively expensive and immensely labor-intensive, thereby establishing a major bottleneck for overall farm productivity and scalability. Existing mechanical implements are not sufficiently discerning to eliminate weeds without causing concurrent harm to the desired plants. Conversely, the broad-scale application of synthetic herbicides, though effective and widespread, is increasingly criticized due to its profound detrimental consequences for environmental sustainability and public health. In light of these shortcomings, this analysis investigates the constraints of traditional weeding techniques and posits that a transition towards smart, autonomous robotic systems represents a necessary evolution. Such a system, exemplified by the ‘Maker’ technology, utilizes advanced computer vision algorithms for plant discrimination and high-precision mechanics for targeted physical intervention. This sophisticated form of automation is poised to establish a highly efficient and cost-effective pathway for the future of weed control, offering a particularly transformative potential for the specific operational and economic realities of Indian smallholder farming operations.

Keywords: agricultural automation, sustainable weed control, precision agriculture, robotic weeding, Indian agriculture

Investigation on Hybrid Footstep and Vehicular Pressure Energy Harvesting System with Advanced Storage Solutions

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Abstract:

Development of alternative power generation sources is necessary to cater to the increasing demand for sustainable energy solutions. With this view, this study presents a footstep energy harvesting system utilizing piezoelectric materials to convert mechanical energy into electrical energy. The system integrates piezoelectric sensors within a flooring structure to capture and convert mechanical stress or pressure into electricity, which is further stored in a battery and also can be used to power low-power applications. This research focuses on material selection, enhancing energy conversion, and implementing effective power management ideas. The aim is to develop and test a footstep energy harvesting system under different load conditions to assess its energy harvesting capability. The system is particularly suited for high-traffic areas such as public places, railway stations, and shopping malls. Both experimental results confirm the effectiveness of this approach in generating sustainable power. The potential of piezoelectric technology in renewable energy harvesting is offering an alternative to conventional power sources while promoting environmentally friendly solutions. Future research will aim to improve efficiency through advanced circuit design and multi-layered transducer configurations.

Keywords: Piezoelectric Energy, Sustainable Power, Smart Flooring Systems, Renewable Energy, Footstep Energy Harvesting.

Evaluation of Existing Structures Using Rebound Hammer Testing

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Abstract: This research paper examines the assessment of currently reinforced concrete construction through rebound hammer testing and statistical and comparative tests. Four buildings of varying ages, functions, and environmental exposures were assessed to determine in-situ compressive strength, concrete quality, and structural condition. In-situ compressive strength, concrete quality, and structural condition of four buildings of various ages, functions and environmental exposures were assessed. The results indicated that Building 3 recorded the highest rebound and compressive strength that exhibited good quality concrete; Building 2 recorded constant performance that was moderately competent Building 1 recorded weaker strength particularly in columns and Building 4 recorded weakest strength that was below the safety levels. These results were supported by frequency histograms and normal distributions curves where Building 2 and 3 had more uniform concrete quality whereas Building 4 had the most inconsistency with deterioration or workmanship. Generally, the research demonstrates that the use of rebound hammer testing is a more efficient non-destructive technique that can be used to perform first-line testing, though secondary techniques and repair techniques should be employed to address weaker structures.

Keywords: Non-Destructive Testing (NDT), Rebound Hammer, Reliability, Retrofitting, Structural Evaluation.

Comparative analysis of dry, flood, MQL and cryogenic machining of EN-19 Steel

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Abstract: Machining of alloy steels such as EN-19 (AISI 4140) poses significant challenges due to their high strength, toughness, and poor thermal conductivity, which cause excessive tool wear and poor surface finish. The selection of an appropriate cooling and lubrication technique greatly influences machining performance and sustainability. This paper presents a comprehensive comparative study of dry, flood, minimum quantity lubrication (MQL), and cryogenic machining of EN-19 steel with respect to cutting temperature, surface roughness, tool wear, material removal rate (MRR), and energy efficiency. Experimental and literature-based analyses reveal that while dry machining offers environmental benefits, it leads to elevated temperatures and rapid tool wear. Flood cooling improves surface finish but consumes large volumes of coolant, raising ecological concerns. MQL provides an optimal balance between lubrication and minimal coolant usage, reducing friction effectively. Cryogenic cooling using liquid nitrogen significantly minimizes tool wear and enhances surface integrity but requires complex setup and higher cost. The study concludes that MQL offers the most sustainable alternative for moderate cutting conditions, whereas cryogenic cooling is ideal for precision and hard-material machining.

Keywords: MQL, cryogenic machining, Taguchi method, Comparative analysis etc.

Construction Cost Estimation Using Machine Learning

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Abstract:

Estimation of construction costs is considered as very important for effective budgeting, planning, and decision-making in civil infrastructure projects. The widely used traditional methods of construction cost estimation often rely on historical trends of the cost analysis, expert judgment, and manual calculations, the processes which can be time-consuming and prone to human error. This study proposes a machine learning-based approach to automate and enhance the accuracy of construction cost prediction using a multi-output regression framework a comprehensive dataset of 10,000 construction instances was compiled from various sources; it includes parameters such as material types, structural categories, area in square feet, and labor specifications among others. Multiple regression models including Random Forest, XGBoost, Gradient Boosting, Decision Tree, and Linear Regression were trained and evaluated using standard performance metrics which include Mean Absolute Error (MAE), Root Mean Squared Error (RMSE), and R² Score. Among these, XGBoost outperformed all others with an R² score exceeding 0.999. To facilitate easy use, a Flask web application has been developed accordingly to deploy said models and deliver immediate predictions predicated-upon dynamic user inputs thus rendering estimation seamless facilitating scalability. The proposed solution not only streamlines the estimation process but also provides a scalable and interpretable tool for engineers, contractors, and stakeholders. Experimental results demonstrate that ensemble learning models are highly effective in capturing the nonlinear relationships inherent in construction data, thereby offering a robust alternative to conventional estimation practices.

Keywords: Construction Cost Estimation, Multi-output Regression, Predictive Modeling.

Integrating Artificial Intelligence with Solar Fabric Greenhouse Technology: A Review and Framework for Future Sustainable Agriculture

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Abstract:

The growing demand for sustainable food production has made Controlled Environment Agriculture (CEA) and greenhouse systems essential. However, conventional approaches remain energy-intensive and heavily reliant on fossil fuels. The future of sustainable greenhouses can be built on two key pillars: energy-autonomous materials and AI-driven precision control. Greenhouse technology has evolved with a strong focus on renewable energy integration, particularly solar-based solutions, as demonstrated by Tiwari et al. [1] and Singh et al. [2]. Recent advances extend beyond traditional photovoltaic panels toward energy harvesting textiles. Researchers such as Arumugam et al. [3] and Li et al. [4] highlight the potential of embedding organic and dye-sensitized solar cells (DSSC) into fabrics, giving rise to the concept of the —solar fabric greenhouse. This approach enables the greenhouse structure itself to function as a generator of clean energy. Yet, energy generation alone cannot ensure sustainability. Artificial intelligence plays a vital role as the intelligence layer, coordinating climate regulation, ventilation, and optimized resource allocation. By integrating sensor networks, AI-controlled BLDC ventilation, and smart decision-making systems, greenhouses can achieve resilience, efficiency, and high yields. We propose a framework for Solar Fabric Greenhouses Equipped with Artificial Intelligence (SFG-AI). This system merges solar fabric based energy harvesting with AI-enabled precision management, offering a pathway to energy autonomy, reduced carbon reliance, and year-round sustainable food production. Together, these innovations represent a transformative shift in greenhouse design, bridging renewable energy generation with intelligent environmental control for the next era of agriculture.

Keywords: Artificial Intelligence, Solar Fabric Greenhouse, Controlled Environment Agriculture, Energy-Harvesting Textiles, Sustainable Agriculture, Smart Farming, Photovoltaic Textiles.

A Contemporary Review: Directional Solidification and its Critical Role in Mitigating Casting Defects and Enhancing Product Quality

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Abstract: Directional solidification is a fundamental principle in metallurgy and casting technology, where heat is extracted preferentially from one end of a casting to promote a controlled, unidirectional growth of the solidification front. This controlled growth is paramount in determining the final microstructure, which directly governs the mechanical properties and quality of cast components. This literature review synthesizes recent research to analyze the profound impact of directional solidification on the formation and suppression of critical casting defects such as porosity, hot tears, freckles, and stray grains. Furthermore, it explores the application of Directional solidification (DS) principles in advanced manufacturing processes like single-crystal and directionally solidified superalloy production, investment casting, and additive manufacturing. The review concludes that a mastery of directional solidification, often achieved through sophisticated numerical modeling and process control, is indispensable for producing high-integrity castings for demanding aerospace, energy, and biomedical applications.

Keywords: Directional Solidification, Casting Defects, Microstructure, Additive Manufacturing, Numerical Simulation.

Global Disparities in Electric Vehicle Charging Infrastructure: A Comprehensive Assessment of Technological Readiness and Distribution Patterns

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Abstract: This study presents a comprehensive analysis of global electric vehicle charging infrastructure based on 242,417 charging stations across 121 countries. Our investigation reveals significant disparities in both the distribution and technological sophistication of charging networks worldwide. The United States leads in quantitative deployment with 82,138 stations, followed by the United Kingdom (26,825) and Germany (23,373), collectively representing over 65% of the global infrastructure. However, technological leadership follows a different pattern, with South Korea, Qatar, and Macao demonstrating superior charging capabilities despite their smaller networks. The analysis shows that only 21% of global stations offer fast DC charging, with an average power output of 34.8 kW and 2.0 ports per station. We developed a novel Future Readiness Index that incorporates power capacity, port availability, and fast-charging capability, revealing dramatic variations between nations. South Korea achieved the highest readiness score of 30.42, while many developing nations scored 500 times lower. Statistical analysis identified a strong positive correlation between fast charging capability and future readiness ($r=0.999$, $p<0.001$), highlighting the critical importance of technological quality over mere quantitative deployment. These findings underscore the urgent need for policy interventions that address both infrastructure quantity and quality to ensure an equitable transition to electric mobility worldwide.

Case Study on Lean Manufacturing: Implementation and Results in a Medium-Sized Auto Parts Manufacturer

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Abstract: Case study reconnoiters implementation of lean manufacturing principles in a medium size manufacturing company of automotive parts. Study targets identify key areas of waste, application of tools like kaizen, Kanban, value stream mapping, measuring and study its impact on productivity, operational efficiency & quality. We highlight the results in terms of inventory levels, lead time & engagement of employee.

Key words: Waste, inventory, productivity.

Review on Design of Industrial Gear Box

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Abstract: Industrial gearboxes are critical mechanical systems used in a wide range of industries, including manufacturing, mining, power generation, and transportation. They serve the essential function of transmitting power between shafts while adjusting torque and speed according to operational requirements. The design of industrial gearboxes involves the integration of mechanical design principles, materials science, lubrication technology, vibration control, and failure analysis. This paper reviews the evolution, design methodologies, key considerations, and technological advancements in industrial gearbox design. Emphasis is given to load capacity, efficiency, thermal management, noise reduction, and reliability, as well as emerging trends such as smart gearboxes, advanced materials, and additive manufacturing.

Keywords: Gear Box, Design, Industrial application.

Coin-Based EV Charging Station Using Arduino

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Abstract: The coin-based electric vehicle (EV) charger with Arduino offers a simple and affordable solution for EV charging. This system integrates a coin-operated mechanism with an Arduino microcontroller to regulate and control the charging process. Designed as a pay-per-use model, it ensures fair billing while reducing infrastructure stress, making it a user-friendly option for EV owners. The charger consists of key components such as an Arduino board, a coin acceptor, a power management unit, and a charging interface. The Arduino acts as the central controller, processing signals from the coin acceptor and managing the charging operation. When coins are inserted, the coin acceptor sends a signal to the Arduino, which then communicates with the power management unit. This unit converts AC input into DC output, regulating current and voltage to ensure safe, efficient charging. The charging interface provides the necessary connection for EVs to draw power. Once charging is completed or terminated, the Arduino stops power delivery and resets for the next user, enabling a reliable, efficient, and cost-effective charging system.

Keywords: EV charging station, Arduino, Coin acceptor, Printed Circuit Board (PCB)

Impact of Modular Construction on Project Execution & Cost Efficiency

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Abstract:

This study presents a detailed comparative analysis of traditional and modular construction methods through the execution of a G+7 residential apartment project comprising two identical wings—Wing A (constructed via traditional methods) and Wing B (executed using modular construction techniques). The primary objective is to assess the impact of modular construction on project execution time and cost efficiency. The findings reveal a 29% reduction in construction duration, with the modular method completing the project in 421 days compared to 590 days for the traditional method. In terms of cost, modular construction demonstrates a 9% overall savings, reducing expenses from Rs 21.18 cr to Rs 19.21 cr. These savings are attributed to factors such as prefabrication, minimized material wastage, efficient labor use, and better site coordination. One of the significant advantages of modular construction is its ability to streamline project timelines by allowing simultaneous site preparation and off-site module manufacturing. Additionally, modular construction showcased improved quality control, reduced weather dependency, and enhanced site safety. This research underscores the potential of modular construction to revolutionize the building industry by offering faster delivery, significant cost reductions, and improved project management. The results highlight its applicability, especially in urban and time-sensitive construction projects, supporting a shift towards more sustainable and efficient construction practices.

Keywords: Modular Construction, Time Efficiency, Cost Optimization etc.

Design and Development of a Smart and Portable Oil Skimmer

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Abstract:

Oil is a vital global energy source, yet oil spills in industrial tanks, rivers, or small water bodies present a major environmental challenge by harming aquatic life and reducing water quality. Thus, an oil spill also is a biological, economical, and social disaster. However the large-scale skimmers exist, their size, cost, and operational complexity make them unsuitable for small or scattered spill areas. To address this issue, a smart system utilizing Arduino technology has been developed: the lightweight and efficient belt-type oil skimmer named 'AQUATEX' is designed to be so efficient that it skims the oil layer and simplifies the cleanup process. Oil is mainly separated by water using the oleophilic property of polyurethane (PU), having an effectiveness of 85-90%. The innovative system is the integration of multiple sensors, including a moisture sensor, ultrasonic sensors, and IR sensors, combined with a Bluetooth-based mobile interface for real-time monitoring. This idea is a true and unique solution that employs modern technologies in a highly stable, efficient, and economical oil skimmer. Results have potential applications mainly in small-scale sewage treatment plants in industries and societies. This solution offers a portable and eco-friendly smart approach to oil spill cleanup, making it particularly easy to use in India's small or scattered areas.

Keywords: Oil Skimmer, Moisture Sensor, IR sensor, Ultrasonic sensor.

A GA-TOPSIS Multi-Objective Optimization of Inconel 718 Turning with A Self-Propelled Rotary Tool

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Abstract:

Superalloys like titanium and nickel are highly sought after in aircraft manufacturing due to their strength, durability, and chemical resistance, necessitating precision in machining. However, high machining temperatures limit their machinability. Understanding geometric dimensions and tolerance (GD&T) characteristics during machining is critical for proper manufacture and fit. GD&T is a specified system for communicating technical tolerances, ensuring part consistency and interchangeability in manufacturing when accuracy and dependability are critical. This study optimizes the machinability of Inconel 718 when turned with a self-propelled rotary tool (SPRT) using nanofluid under a minimum quantity lubrication (NFMQL) environment. It takes into account tool life, surface roughness, work hardness, and radial GD&T parameters such as circularity, cylindricality, and radial runout. The best compromise solution and Pareto solutions were developed using a hybrid multi-objective Pareto technique that merged a genetic algorithm with the Technique for Order of Preference by Similarity to the Ideal Solution. This study suggests that Inconel 718 can be turned more successfully using SPRT under nanofluid minimum quantity lubrication (NFMQL) situations, with a reduced feed and depth of cut of 0.1 mm/rev and 0.2mm, respectively, and a cutting speed of 30 to 60 m/min. These standards restrict circularity and cylindricity deviations to 10 μ m, and radial run out to 0.4 mm. Surface roughness, tool life, and work-piece hardness were assessed at 1.19-1.72 μ m, 3.52-7.56 min, and 36-39 HRC, respectively.

Keywords: Inconel 718, Machinability, Rotary tool, GD&T, Optimization.

A Review on seismic performance of tall structure with Transfer structure and Backstay effect

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Abstract:

This review focuses on the seismic performance of tall reinforced concrete buildings incorporating transfer structures and backstay effects. Transfer structures are used to redistribute loads in buildings with open lower floors, while backstays enhance lateral stability at tower-podium junctions. These design features, though improving functional space, introduce stiffness irregularities that influence seismic response. The study examines key challenges such as soft-storey effects, torsional irregularities, inter-story drift, and base shear, highlighting strategies for safer and more efficient tall building design in urban environments. The study also emphasizes the optimization of vertical space in urban areas to accommodate public amenities, reduce overcrowding, and improve overall structural safety.

Keywords: Seismic performance, Transfer structure, Backstay effect

Interaction Buckling Behavior in Cold-Formed Steel Column

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Abstract: This study investigates local–distortional (L–D) interactions on post buckling strength of fixed-ended lipped channel cold-formed steel (CFS) columns. Eight column sections with different geometries and yield stresses were selected to capture strength-related parametric ratios, particularly the distortional-to-local critical buckling stress ratio ($0.91 \leq P_{crd}/P_{cl} \leq 2.82$). Linear and nonlinear shell finite element analyses (FEA) were performed using ABAQUS incorporating geometric and material nonlinearities. The numerical results examined post-buckling behavior, failure modes, and ultimate strengths influenced by L–D interaction. The predicted strengths were compared with Direct Strength Method (DSM) design curves for local and distortional buckling in AISI S100 and existing DSM-based approaches for L–D interaction failures. The study shows L–D interaction significantly reduces column strength in specific ranges, with DSM predictions being either conservative or non-conservative based on interaction level. The findings highlight current DSM limitations in capturing interaction effects and emphasize the need for refined design recommendations to improve strength predictions of cold-formed steel members.

Keywords: lipped channel columns; local–distortional interaction; cold-formed steel; Direct Strength Method (DSM); finite element analysis; Generalized Beam Theory (GBT)

Integrating Advanced Software & value Engineering for Enhancement of Time & Cost In A Residential Building Project

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Abstract: For construction of residential project to run smoothly, effective planning and scheduling are crucial, the time-cost enhancement and value engineering was carried out in this research by using software like AutoCAD, Primavera P6 and Microsoft Excel, in this methodology starts with initial planning of the overall project which includes quantity calculation (labour and material). Baseline plan and resource loading was carried out in Primavera P6 software, setting the baseline duration to 876 days and the total planned cost to Rs 8,62,69,844.93/- actual loading of duration and cost took place and project was scheduled by which it was identified that the project was delayed by 8 months and remaining duration of project was 116 days, crashing method was adopted for the enhancement of this remaining duration and cost, for which labour cost was considered. As a result, the remaining duration reached 86 days and the increase in labour cost was Rs 3,05,336.99/-. In the value engineering method, initially AutoCAD drawings of the building were manually analysed by which author identified the extra unnecessary elevation space on each slab, from which the overall cost of the project was increased, so as an approach to save the cost author calculated the material and labour cost required for the construction of elevation i.e. Rs 35,92,278/-, so it is concluded that by reducing the elevation to 50% approximately 50% cost can be save i.e. Rs 17,96,139/-, this techniques can be useful for the reducing the cost of future projects.

Keywords: Time-Cost, Primavera P6, Value Engineering, Critical Path Method.

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Earned Value Management & Risk Analysis of an Industrial Project Using Advanced Software

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Abstract:

Earned Value Management (EVM) is a project management method that monitors project performance by integrating cost and schedule. In this research, the Sequencing Batch Reactor (SBR) Building of a wastewater treatment plant (WWTP) was taken as a case study, where various software, including Primavera P6, Risk Analysis, and Microsoft Excel, were utilized. The Microsoft project plan was imported into Primavera P6, and resources were loaded as per the Excel sheet. To identify the earned value matrices four different quarters from the start of the project were considered, in which the first quarter matrices were (CPI- 1.08 & SPI- 0.28), the Second (CPI- 1.06 & SPI- 0.55), the third (CPI- 1.29 & SPI- 0.81) & Fourth (CPI- 1.47 & SPI- 0.92), For improving the metrics for the remaining project author has used the crashing method as an approach. In which the planned duration for one quadrant was 231 days and the labour cost was Rs 2,43,35,838/-, which changed to 192 days and the labour cost increased to Rs 3,24,71,366/-. The author has imported the plan into risk analysis software for predicting the project duration. In risk analysis software, standard risk was considered, and a report was run at 1000 iterations. As a result, distribution graphs were obtained, i.e., Finish date graph gives the statistics of the minimum 15/07/2025, maximum 14/09/2025, and mean 11/08/2025. The start date distribution graph gives the statistics of 27/12/2024. And the Duration distribution graph gives the statistics, minimum duration of 201 days, maximum of 262 days, and mean duration of 229 days.

Keywords: Earned Value Management, Waste Water Treatment Plant, Risk Analysis, Sequencing Batch Reactor.

An Analysis to Identify the Willingness of Commuters to Support the Metro Transit System in Mumbai Metropolitan Region (MMR)

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Abstract:

The study's main objective was to determine how likely voters in a certain area were willing to support public transit (WTST). The WTST Index, a tool created to track the movement from opinion to action—basically, how opinions about public transportation might convert into concrete support, such as voting in favor of funding initiatives—was used for this assessment. Because it distills complicated public opinion into a simple set of questions that can reasonably anticipate voter behavior, by doing this, stakeholders can better identify which demographic groups are most likely to support or oppose transportation efforts, which can assist inform the creation of policies and communication strategies. The study investigated the effects of a number of variables on the WTST Index, including geographic location, Socio-demographic traits (such as age, income, and education), and particular views toward transit. One of the main conclusions was that a person's Social and ideological beliefs have a big impact on whether or not they favor public transit. Furthermore, educational attainment and income levels were significant factors. The complicated and occasionally conflicting nature of public opinion regarding transportation is highlighted by this trait. Particularly in regions with underdeveloped or underutilized transit networks, the diversity identified by the index offers vital information for organizing future transportation projects. The WTST Index, in the end, provides a useful, data-driven method for comprehending and enhancing public support for transit initiatives, which is essential for developing and updating metropolitan areas' transportation systems.

Keywords: Urbanization, Public transport, Willingness to Support Public Transit (WTST), TRANSIT SYSTEM, MMR.

Study of Waste Heat Sources in Vapor Compression Systems and a Case Study on the Heat Recovery Unit of a Bulk Milk Cooler

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Abstract: Vapor compression refrigeration systems are widely used in food and dairy industries, yet they release a substantial amount of waste heat into the environment. This heat, if effectively recovered, offers a major opportunity to improve overall energy efficiency and reduce greenhouse gas emissions. The main sources of waste heat in vapor compression systems include condenser heat rejection (60–80%), compressor losses (10–15%), and desuperheating processes (10–12%). Several recovery techniques, such as compact heat exchangers, heat pumps, and Organic Rankine Cycles (ORCs), have been reported to achieve 15–40% energy savings depending on scale and application. In this study, a case analysis is presented on a Bulk Milk Cooler (BMC) installed at Arale village, where a Waste Heat Recovery Unit (WHRU) was integrated between the compressor and condenser. The system recovered approximately 16.76 MJ/h of heat, which was successfully utilized for heating 180 liters of water from 30 °C to 50 °C. The results indicate a favorable heat recovery factor and improvement in system COP, along with annual energy savings and measurable CO₂ reduction. Challenges such as initial investment cost and retrofitting complexity are also addressed. The study concludes that WHRU integration enhances both energy efficiency and sustainability in dairy-based refrigeration systems.

Keywords: Waste Heat Recovery, Vapor Compression Systems, Heat Exchangers, Bulk Milk Cooler

A Review on the Impact of Geometric Configuration on the structural integrity of tensegrity footbridge

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Abstract: This paper uses different literature reviews to investigate the structural analysis of various tensegrity footbridge configurations. Tensegrity structures, characterized by their unique combination of tension and compression elements, offer potential advantages for footbridge design, including lightweight and aesthetic appeal. Accurate assessment of their structural behavior under various loading conditions is crucial. Key indicators such as stability, member stress distribution, and deflection are systematically assessed to understand the load-bearing mechanisms and serviceability of each design. Through this comparative framework, the research identifies optimal configurations tailored to specific design requirements drawing upon an extensive review of existing literature. The findings provide critical insights and practical guidelines for engineers, facilitating the efficient and reliable application of tensegrity principles in the practical construction of innovative footbridges. This study employs an analysis of several tensegrity footbridge configurations, evaluating their performance in terms of stability, stress distribution, and deflection. The use of comparative analysis enables the identification of optimal configurations for specific design requirements and provides insights into the efficient application of tensegrity principles in practical footbridge construction and comment which is most optimistic geometric configuration to preserve the structural integrity.

Keywords: Tensegrity system, Footbridge, Structural Analysis.

AI in Seismic Design of RC Frames: A State-of-the-Art Review

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Abstract: Reinforced concrete frames, foundational to modern infrastructure, remain susceptible to seismic events, leading to structural failures and economic losses. Traditional design methods rely on simplified assumptions, failing to address complex non-linearities. This systematic review from 2018-2025 synthesizes advancements in AI methods including Artificial Neural Networks, Convolutional Neural Networks, Deep Learning, and Hybrid Genetic Algorithm ANN approaches for seismic RC design. Our analysis reveals AI's impact: ANNs reduce shear strength prediction error by up to 20%, CNNs achieve over 95% accuracy in crack detection, and hybrid models deliver 18% reinforcement savings. Deep learning lowers fragility prediction error by 30%. This paper presents a taxonomy of AI techniques and proposes an integration framework to align AI outputs with engineering practice and design standards. This research demonstrates AI's potential to enhance structural resilience, accelerate sustainable housing solutions, and drive digital transformation of seismic design workflows for robust, cost-effective construction. These advancements highlight the importance of incorporating AI into seismic design to improve safety, accuracy, and efficiency. Future research should focus on large-scale validation, real-world implementation, and seamless integration with existing engineering codes and practices to ensure practical applicability and widespread adoption across the construction industry.

Keywords: AI, seismic design, reinforced concrete, machine learning, structural engineering.

Design and Development of Solar based Water Purification and Off-Grid Energy Utility System

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Abstract: Access to clean drinking water and reliable electricity is still a major challenge in rural and off-grid areas. This issue impacts health, education, and economic growth. This research outlines the design, development, and simulation of an integrated solar-powered purification and off-grid energy system to meet these crucial needs. The system combines a solar photovoltaic (PV) array with a MPPT-based DC-DC boost converter, a Battery Management System (BMS)- managed battery pack, and a Universal Bridge Inverter to provide stable AC power for household appliances like lights, fans, and phone chargers. A UV-based water purification subsystem includes a pump, sand and carbon filters, and a UV disinfection chamber. The simulation analyzes performance parameters like solar power generation, battery State of Charge (SOC), inverter output quality and energy used by the purification system. The results show that the system can provide a reliable energy supply and effective water purification under different solar irradiance and load conditions. This work supports sustainable development by encouraging the use of renewable energy and improving public health, making it a practical solution for rural communities that lack access to energy and water.

Keywords: Solar PV System, MPPT, Renewable energy, off-grid, UV water Purification
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Analysis of various defect at various speed and the size of defect of deep groove ball bearing

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Abstract: Deep groove ball bearings are among the most widely used machine elements in rotating equipment due to their simple design, high load capacity, and reliability. However, the presence of defects such as surface wear, cracks, spalling, and lubrication failures significantly affects their performance and reduces service life. Early detection and accurate analysis of these defects are essential for preventing presents a reference study on various types of defects occurring in deep groove ball bearings, their effects on vibration response and system reliability, and the available detection techniques. Emphasis is given to vibration analysis methods, as they are the most widely adopted in condition monitoring, along with a review of advanced approaches such as acoustic emission and machine learning. The discussion highlights key research findings, challenges in defect identification, and the potential of smart monitoring technologies. The study concludes that integrating modern signal processing with intelligent predictive tools can provide significant improvements in defect diagnosis and enhance the operational reliability of rotating machinery.

Keywords: Deep Groove Ball Bearing, Defect Detection, Vibration Analysis, BPFO, BPFI, Types Of Defect, Size of Defect, Shapes of Defects

Automated Irrigation System based on IOT Technology Powered by Solar Panel

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Abstract: Agriculture forms India's economic backbone, employing the majority of the population and significantly impacting national GDP. Technological optimization of farming practices has become essential for sustainable agricultural growth. This project develops an automated irrigation system integrating Arduino microcontrollers, soil moisture sensors, solar power, and IoT technology. The system continuously monitors soil moisture and automatically activates pumps when levels drop below preset thresholds, ensuring optimal plant growth while minimizing water waste. Water scarcity, irregular rainfall, and excessive consumption demand efficient irrigation management. Traditional methods waste significant water and require constant supervision. This solution provides precise, sensor-driven control adapting to real-time soil conditions. The system excels in arid regions with unpredictable rainfall. Remote monitoring capabilities enable efficient farm management without physical presence, reducing labor costs and time investment. Key benefits include substantial water conservation, reduced operational expenses, and improved crop consistency. Solar integration ensures sustainable power generation with minimal environmental impact. IoT connectivity provides real-time monitoring and remote control through mobile applications, demonstrating technology & potential to transform agricultural practices.

Keywords: Internet of Things, Arduino UNO, MATLAB, Solar Panel, Smart Farming, Automated Irrigation System.

Design an efficient battery management system for two-wheeler EV.

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Abstract:

The rapid growth of electric mobility, particularly in densely populated regions, has highlighted the increasing role of two-wheeler electric vehicles (EVs) as affordable and sustainable transport options. The battery remains the most critical subsystem of such vehicles, determining not only performance but also user safety and operational lifetime. A Battery Management System (BMS) ensures safe operation by monitoring cell voltages, currents, and temperatures, while also implementing algorithms for state estimation, balancing, and protection. This review paper provides a consolidated perspective on the current developments in BMS technologies, with emphasis on their application in electric two-wheelers. Literature spanning recent years is analyzed to compare different state-of-charge (SOC) and state-of-health (SOH) estimation approaches, including Coulomb counting, open-circuit voltage analysis, model-based observers, and data-driven methods. Various cell balancing techniques are examined, ranging from cost-effective passive balancing to more sophisticated active balancing architectures. Standards for safety and functional reliability, along with emerging IoT-enabled BMS designs, are also discussed. The synthesis of findings reveals that while several estimation and balancing methods demonstrate promising accuracy in laboratory settings, practical implementations for two-wheeler applications face limitations related to computational cost, affordability, and robustness under dynamic conditions. The review concludes by identifying research gaps in real-time SOC/SOH estimation, integration of lightweight artificial intelligence models, and second-life battery utilization, while outlining opportunities for developing intelligent, safe, and cost-effective BMS solutions tailored for the rapidly expanding two-wheeler EV market.

Keywords: Battery Management System (BMS), State of Charge (SOC), State of Health (SOH), Cell Balancing, Internet of Things (IoT).

Self-Redevelopment: A Strategy for Affordable Housing

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Abstract: Land prices remain a critical determinant of housing costs, particularly in high-demand urban areas. Relocating to peripheral zones may reduce land expenses but often results in inadequate infrastructure and extended commuting times, making the balance between affordability and location a persistent challenge. In conventional redevelopment, the mismatch between landowners' premium expectations and developers' cost-risk feasibility frequently hinders negotiations and compromises project viability. On the other hand, self-redevelopment offers potential for affordable housing, especially where land is already owned and constitutes a major share of project costs. However, high premiums, elevated interest rates, and complex regulatory frameworks often constrain its feasibility. Enhancing viability requires targeted interventions such as interest subsidies, reduced FSI premiums, streamlined approvals, adequate technical support, and customized financing mechanisms. This study examines the interface between self-redevelopment and land utilization patterns, highlighting its capacity to optimize space allocation, encourage densification, promote mixed-use development, and support sustainable urban growth. By analyzing its operational dynamics and outcomes, the study underscores the potential of self-redevelopment as a community driven mechanism for addressing affordability challenges and reshaping urban housing strategies. Positive recommendations for amendments in current self redevelopment framework provisions are made to make it more lucrative.

Keywords: Economically Weaker Section, Low Income Group, Development Control Promotion Regulations, Self-Redevelopment

A Review on Vinyl Ester Composites

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Abstract: The utilization of lignocellulosic fibre-reinforced composites in conjunction with thermosetting resins such as polyester and vinyl ester has emerged as a prominent area of investigation within materials science and engineering. Although extensive studies have been conducted on natural fibres as reinforcement agents, comparatively less emphasis has been placed on the influence of the polymeric matrix in governing the overall composite performance. Polyester and vinyl ester matrices, in particular, exhibit distinct physicochemical and mechanical characteristics that render them highly suitable for demanding structural as well as functional applications. The present review systematically examines the behavior of natural fibres incorporated into these matrices, with specific focus on fibre selection criteria, interfacial adhesion mechanisms, and the subsequent improvements in thermo-mechanical response. Furthermore, the discussion includes an assessment of prevalent failure modes in such hybrid systems, thereby providing critical insights into their structural dependability and pro- spective engineering applications.

Key words: Natural Fiber, Polyester, Vinyl Ester.

The Contact Analysis for Deep Groove Ball Bearing Based on MATLAB And ANSYS

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Abstract:

This study investigates the contact stress and vibration behaviour of a 16007 deep-groove ball bearing through a combined analytical and numerical approach. Hertzian contact theory was applied using MATLAB to determine maximum contact pressure and shear stress under four representative load conditions—3900 N (safe zone), 7800 N (working load), 13,000 N (fatigue limit), and 15,600N (overload). Vibration spectra were then generated by modelling fundamental shaft frequencies, ball pass inner race frequencies, and harmonics, with amplitudes scaled according to stress levels. These analytical results provided insights into the nonlinear rise in stress and vibration amplitude as load increased. To validate and complement the theoretical findings, three-dimensional contact simulations were performed in ANSYS using tetrahedral meshing and no-separation contacts between balls and races. Radial loads were applied to the inner race while constraining the outer race, and the analysis yielded von Mises stress distribution, elastic strain, and deformation patterns. Results revealed that Hertzian theory provides conservative peak stress predictions, while ANSYS simulations capture detailed spatial stress concentrations at the ball–race interfaces. Comparative analysis of MATLAB and ANSYS outputs demonstrated a clear correlation between load escalation, vibration amplitude growth, and localized stress intensification. The integration of analytical modelling and finite element simulation offers a robust methodology for assessing bearing reliability. The findings emphasize the importance of predictive maintenance strategies, where vibration monitoring combined with stress analysis can enable early detection of fatigue and extend bearing service life.

Keywords: Bearing, hertzian contact, fatigue analysis, MATLAB, ANSYS.

Energy Dissipation and Signal Analysis of Ball-Surface Defects in SKF 16003 Bearing

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Abstract:

This study examines the dynamic effects and fault signatures of ball-surface defects in an SKF 16003 deep-groove ball bearing using numerical simulation. The analysis takes into account various defect geometries, such as triangular grooves, rectangular slots, and round pits, which are indicative of typical wear or localized surface damage that happens in rolling element bearings while they are in use. To assess the impact of defect severity on vibration characteristics, three distinct sizes—0.4 mm, 0.6 mm, and 1.2 mm—are modeled for each defect shape. Both the time and frequency domains of the simulated bearing responses are examined. The impact of defect size and geometry on the overall dynamic response is directly measured by generating time-domain vibration signals and quantifying energy dissipation using the integral of the squared signal. To capture the defect-induced modulations and transient features, time-frequency spectrograms and frequency-domain analysis using the Fast Fourier Transform (FFT) are also included. The findings show that while defect size has a major impact on the amplitude and energy levels, defect geometry significantly shapes the spectral characteristics. These results demonstrate that vibration signatures that vary in size and shape can be used as trustworthy markers for ball bearing fault diagnosis and severity assessment.

Keywords: Bearing defects, Vibration analysis, Energy dissipation.

Predictive Analytics in Motorsports: An AI-Integrated Modular Telemetry System with Custom Sensor Housing

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Abstract:

In the fast-paced world of motorsports, telemetry systems have become indispensable for monitoring vehicle behavior, optimizing performance, and supporting strategic decisions. With the increasing availability of embedded hardware and advanced data science tools, modern telemetry now extends beyond basic sensor logging to include predictive analytics, real-time decision support, and actionable feedback for both drivers and engineers. This paper presents the design and development of an advanced telemetry system that integrates Artificial Intelligence (AI) for predictive analytics, efficient data collection through custom Python-based software, and a visually compelling User Interface (UI) constructed with leading-edge technologies. The system architecture built with Raspberry Pi Pico microcontroller manages real-time processing of sensor inputs which derived from GPS and Gyro-accelerometer modules. High-frequency data streams are captured, preprocessed, and analyzed using machine learning algorithms to generate actionable predictions and alerts. The UI/UX layer employs modern web frameworks to deliver an intuitive, visually engaging dashboard for rapid interpretation of telemetry and predictive insights. Furthermore, a custom sensor housing fabricated from aluminum-type metal is proposed to optimize heat dissipation and ensure reliable thermal management for the embedded electronics, while additional vibration reduction techniques are incorporated to enhance system stability in demanding environments. The modular codebase supports scalability and maintainability, facilitating further integration of sensors or advanced analytics modules. The proposed system demonstrates significant promise for robust, intelligent telemetry solutions in dynamic monitoring applications.

Keywords: Modular Telemetry System, Artificial Intelligence, User Interface, Pi Pico microcontroller, Gyro-accelerometer modules, PredictiveAnalytics

Finite Element Modal and Buckling Analysis of SKF 6312 Deep Groove Ball Bearing

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Abstract:

Bearings are indispensable components in mechanical systems, designed to support shafts, transmit loads, and minimize friction. Among them, the SKF 6312 deep groove ball bearing is widely employed in industrial and automotive sectors because of its ability to withstand both radial and axial forces. This study investigates the modal response and structural buckling behavior of the SKF 6312 bearing using Finite Element Analysis (FEA) in Autodesk Fusion 360. An axial load of 50,000 N was applied to the inner ring while the outer ring was fixed. Modal analysis identified six natural frequencies, with the first mode appearing at about 8856 Hz—well above typical machine operating speeds—indicating negligible resonance risk. Buckling analysis revealed a critical load multiplier of approximately 1684, corresponding to a buckling load of nearly 84.2 MN, confirming a very high safety margin against compressive failure. The results demonstrate that the SKF 6312 bearing, made of AISI 52100 steel, possesses strong structural stability and dynamic reliability under rated conditions. The study highlights the usefulness of FEA in predicting vibration behavior and stability characteristics of rolling element bearings, offering practical insights for safe design, operation, and predictive maintenance.

Keywords: SKF 6312 bearing; Deep groove ball bearing; Modal analysis; Buckling analysis; Finite Element Analysis (FEA); Natural frequency; Structural stability; Fusion 360; AISI 52100 steel; Axial load.

Implementation of Schedule Health Checks for Project Management

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Abstract:

The reliability of project schedules plays a pivotal role in ensuring successful construction project outcomes, yet industry experience shows that schedules, although contractually compliant, often suffer from hidden deficiencies such as open-ended logic, excessive constraints, poor sequencing, and inaccurate progress assignments. This research develops and validates a structured Schedule Health Check Framework within Primavera P6 to systematically evaluate and enhance schedule quality. The framework incorporates diagnostic metrics addressing logical connectivity, activity durations, constraint usage, float analysis, calendar consistency, and critical path validity, drawing upon standards from AACE International and PMI. Its application to a six-month residential and villa construction project in Abu Dhabi, comprising more than 2,400 activities, demonstrated how iterative health checks across baseline and monthly updates facilitated the early detection and correction of scheduling flaws. Key outcomes included the elimination of unnecessary constraints, a 98% reduction in out-of-sequence activities, removal of negative float, improved milestone dependencies, and rationalized activity breakdowns to enhance progress measurement and forecasting accuracy. The findings confirm that systematic health checks transform Primavera P6 into a powerful quality assurance mechanism, elevating schedules from static contractual submissions into dynamic decision-support instruments that empower planners and managers to deliver projects with greater timeliness, cost efficiency, and resource optimization.

Keywords: Schedule Health Checks, Primavera P6, project management, construction scheduling, baseline schedules, master schedules, schedule validation, risk management, critical path, resource and cost loading.

Vibration Analysis and Bearing Life Estimation of 'LMK20UU' and 'SMK20G-LUU' Bearings in Sealing Machines

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Abstract:

Bearings are critical components in rotating machinery, and their performance directly influences the reliability and efficiency of industrial equipment. In this study, the vibration characteristics and service life of two bearings employed in a sealing machine were investigated. Vibration analysis was carried out to identify dynamic responses, defect frequencies, and overall health condition of the bearings under operating conditions. The experimental data were complemented with theoretical calculations to evaluate bearing fatigue life, considering load distribution, speed, and lubrication parameters. The results highlight variations in vibration signatures between the two bearings, correlating specific frequency components with potential mechanical faults such as imbalance, misalignment, or early wear. Life estimation analysis further provided insights into the expected operational reliability and maintenance intervals. This research demonstrates that integrating vibration monitoring with life prediction enables accurate assessment of bearing performance, ultimately enhancing machine availability and reducing unexpected downtime in sealing applications

Keywords : Sealing machine, LMK20UU bearing, SMK20G-LUU bearing, Vibration, BPFO, BPFI, BSF, Bearing Life.

AutoGreen: Smart Robotic Lawn Maintenance with Solar Power and Wireless Control

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Abstract: Globally, the rising need for sustainable development has intensified efforts to reduce environmental impacts while adopting advanced technologies. Among various areas, lawn care remains a highly resource and labour-intensive activity, traditionally dependent on gas-powered machines that generate air and noise pollution. With the growing emphasis on green practices, there is a clear demand for ecofriendly alternatives. Addressing this gap, the concept of a solar-powered, hybrid, and Bluetooth-controlled robotic grass cutter emerges as an innovative solution, integrating renewable energy with automation and wireless control to create efficient, sustainable lawn maintenance. Robotic lawnmowers are already used in parks, gardens, hotels, and institutions, but their reliance on electricity still contributes to energy consumption and global warming. The proposed model incorporates photovoltaic panels to provide continuous, renewable energy, reducing dependence on fossil fuels and lowering carbon emissions. Designed around an Arduino microcontroller, the system enables autonomous operation with pre-programmed cutting patterns, while Bluetooth connectivity allows users to control and monitor functions via a smartphone. An Android application enhances usability by enabling adjustments in cutting patterns, blade height, and operational parameters, ensuring flexibility and user convenience. Beyond sustainability, the robot offers significant practical benefits. Adjustable cutting blades allow tailored lawn maintenance, programmable patterns increase efficiency, and quiet operation minimizes noise pollution, making it ideal for both residential and public spaces. This reduces labour needs, operational costs, and environmental harm compared to conventional methods. Overall, the proposed solar-powered robotic grass cutter exemplifies the integration of renewable energy, automation, and wireless communication.

Keywords: Autogreen; smart robot; lawn maintenance; solar power, wireless control.

Finite element analysis for Deep groove ball Bearing Based on Hertzian theory and ansys

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Abstract : ANSYS was used to create a three- dimensional model of the 6205 deep groove ball bearing. Variations in stress, strain, deformation between the cage, rolling elements, inner ring, and outer ring were investigated using contact analysis. The accuracy and logic of the modeling approach and boundary conditions were demonstrated by the simulation results for maximal equivalent stress, which were found to be congruent with Hertzian contact theory values. The work offers a solid scientific foundation for designing rolling bearings optimally under challenging load and different materials scenario.

Keywords: Deep groove ball bearing; 6205; Parameterization; Finite element analysis; Contact analysis;

Review Paper on Vibration Simulation of Ball Bearings

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Abstract:

Ball bearings are vital components in mechanical systems, enabling low-friction motion and supporting both radial and axial loads in applications such as automotive, aerospace, and industrial machinery. Their reliability is essential, as even small defects can lead to severe mechanical failures. One critical aspect of bearing performance is vibration behavior, which reflects the dynamic interaction between rolling elements, races, and lubrication films. Vibration in ball bearings arises from various sources, including surface wear, localized defects, misalignment, imbalance, and lubrication issues. These conditions generate characteristic vibration signatures—such as fundamental train frequency, ball pass frequencies, and ball spin frequency—that act as diagnostic indicators of bearing health. Accurate detection of these vibrations requires advanced techniques. While traditional accelerometer-based sensing remains common, non-contact methods such as laser vibrometry and acoustic emission analysis are increasingly used to identify early-stage faults and subtle surface irregularities. Excessive vibration accelerates fatigue, increases noise, and promotes failure modes like spalling, pitting, and cage instability. Such failures shorten bearing lifespan and compromise overall system reliability, leading to costly downtime and maintenance. Recent advancements focus on fault detection and predictive maintenance, utilizing signal processing, machine learning, and multi-sensor data integration. Additionally, innovations in bearing materials, surface coatings, and optimized geometries have helped reduce vibration and extend service life.

Keywords: Ball Bearing Vibrations, Vibration analysis, Vibration Signature, Noise and Vibration

Study of Geo Environmental Parameters of Warana River Basin

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Abstract: The Warana River Basin, a major tributary of the Krishna River in western India, encompasses diverse physiographic, climatic, and ecological settings that significantly influence its geomorphic and environmental dynamics. The basin is vital for agriculture, water resources, and regional socio-economic development; however, anthropogenic pressures, land-use changes, and uneven rainfall patterns have altered its geo-environmental conditions. This study evaluates key parameters—including elevation, soil texture, slope, slope aspect, and drainage density—to examine their interrelationships and influence on basin development. Remote Sensing (RS) and Geographic Information System (GIS) techniques were applied to integrate multi-thematic datasets such as satellite imagery, topographic maps, and Digital Elevation Models (DEMs). Geomorphologically, the basin comprises structural hills, plateaus, pediments, and river terraces, which regulate surface runoff, groundwater recharge, and agricultural productivity. The dendritic to sub-dendritic drainage patterns reflect lithological control by the basaltic terrain. Climatic variability, particularly intense monsoonal rainfall, exacerbates soil erosion and sediment transport, creating challenges for sustainable land and water management. The integrated geo-environmental assessment presented here offers critical insights for watershed prioritization, soil and water conservation planning, and sustainable resource management in the Warana River Basin.

Keywords: Warana River Basin, Geo-environmental parameters, GIS, Remote Sensing, Watershed Management

A Comprehensive Review of Post-Casting Cleaning Techniques for Tractor Oil Pans: From Conventional Methods to Advance

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Abstract: The oil pan is a critical tractor engine component, requiring impeccable surface cleanliness to ensure longevity and performance. Casting processes like high-pressure die casting (HPDC) and sand casting introduce contaminants such as lubricants, oxides, and sand. This review systematically examines cleaning technologies for aluminum oil pans, evaluating conventional methods thermal deburring, abrasive blasting, chemical bathing and their environmental and operational limitations. It highlights advanced techniques like high-pressure aqueous jet and cryogenic deburring for their superior sustainability and precision. The analysis focuses on how parameters like pressure, nozzle geometry, and temperature impact cleaning efficacy, assessed through gravimetric and visual standards. The study concludes by identifying future research needs for intelligent, eco-friendly cleaning systems to meet evolving industry demands for quality and sustainability.

Keywords: Tractor Oil Pan, Casting Cleaning, Deburring, Surface Preparation, Aqueous Jet Cleaning, Sustainable Manufacturing, Abrasive Finishing, Review.

A Comprehensive Review of Technology for Gasoline Direct Injection Engines: Advancements, Challenges, and Future Perspectives

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Abstract: Gasoline Direct Injection (GDI) is the predominant fuel delivery strategy for modern spark-ignition engines, adopted to comply with strict international emissions and fuel efficiency standards. Through direct injection of fuel into the combustion chamber, GDI engines achieve superior thermal efficiency, higher specific power output, and reduced cold-start hydrocarbon emissions compared to Port Fuel Injection (PFI) engines. However, this transition has introduced significant challenges, notably elevated particulate matter (PM) emissions and the abnormal combustion phenomenon known as low-speed pre-ignition (LSPI). This paper provides a systematic review of GDI technology, examining its fundamental principles, evolution, and efficiency benefits. It presents a critical analysis of emission challenges and the technological advancements in injector design, combustion strategies, and aftertreatment systems like gasoline particulate filters (GPFs). Finally, the paper explores the future of GDI technology, highlighting its role in hybrid-electric powertrains and its compatibility with alternative fuels.

Keywords: Gasoline Direct Injection, GDI, Particulate Emissions, Fuel Economy, after treatment, Low-Speed Pre-Ignition.

A State-of-the-Art Review on Expanded Metal mesh as Structural Material

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Abstract:

An inventive and adaptable material, expanded metal mesh has drawn interest for its structural and architectural uses in a variety of industries. This study examines the most recent research on expanded metal meshes, focusing on their microstructural properties, potential for advanced engineering applications, and structural performance under various loading scenarios. The paper begins by outlining the benefits of adopting expanded metal meshes, emphasizing both the increasing need for high-performance structural materials and their functional adaptability. The structural behavior of expanded metal meshes under compressive, tensile, shear, bending, and impact loads is also covered in this review. These analyses offer a thorough grasp of their performance and are based on analytical, numerical, and experimental research. According to shear loading testing, expanded metal is appropriate for uses like steel plate shear barriers since the response is mostly determined by panel length and cell design. The importance of cell orientation is highlighted by tensile behavior experiments, which show that flattened meshes absorb more energy and are more stable than typical topologies. New applications include energy-efficient designs for seismic retrofitting.

Keywords: Expanded metal, Shear loading, Seismic retrofitting.

A Smart Mouse Interface for Detecting Mental Fatigue

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Abstract:

Long hours working in front of computer screen without break is today's reality for many IT professionals. This routine supports high output but brings many side effects such as mental stress and mental fatigue, loss of focus eventually results in gradual decline in work efficiency and reduced mental well-being. Tools for monitoring mental fatigue have been developed, but most rely on bulky equipment, are intrusive, or are too costly for everyday office use. In the present work, a smart mouse is designed that turns an ordinary computer mouse into a fatigue tracking device. Two sensors: photoplethysmography (PPG) pulse sensor and infrared temperature sensor are attached to the ordinary mouse which records signals like heart rate and skin temperature. The information from both sources is processed with a Python program running in the background to monitor and display the pulse rate and temperature of the human body on a user interface. The smart mouse can alert the professionals and help to reduce the risk of burnout. Simplicity, low cost, and ease of setup make the mouse suitable not only for offices but also for remote work and educational settings.

Keywords: Mental fatigue, photoplethysmography pulse sensor, infrared temperature sensor.

RC Frames Under Quake Loading: A Fragility Study

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Abstract:

This study evaluates the seismic performance and fragility of reinforced concrete moment-resisting frames with variations in height (3, 6, 12 storeys), plan geometry (square, L, T), slab thickness, seismic detailing (strong-column weak-beam, SCWB vs non-SCWB), and masonry infill presence. Nonlinear static pushover analyses using the ATC-40 capacity spectrum method identified yield and ultimate control points, while seismic response modification factor (R) was decomposed into overstrength, ductility, and redundancy components. Fragility curves were developed within the HAZUS framework using lognormal functions and performance thresholds derived from drift ratios. Results show R and fragility are highly sensitive to P-Δ effects, plan irregularity, slab thickness, detailing, and infill walls: SCWB improves ductility and R, infill increases overstrength but reduces ductility, and P-Δ degrades post-peak capacity. L-shaped and taller buildings exhibit greater seismic vulnerability. The study recommends model-specific R evaluation, explicit inclusion of infill, and validation with dynamic analyses.

Keywords: Reinforced concrete, fragility curves, capacity spectrum, pushover analysis, seismic performance, R-factor, masonry infill

Design and Analysis of Propeller Blades used in Drone Application

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Abstract:

The operational performance of drones, especially Vertical Take-Off and Landing (VTOL) UAVs, is strongly dependent on propeller efficiency. Among the dominant factors, propeller geometry and tilt angle largely influence stability, thrust, energy use, and control accuracy. This study addresses the design, simulation, and experimental assessment of optimized propeller blades for agricultural UAVs, focusing on tilted propeller arrangements essential for VTOL operations. The research examines how blade geometry, material properties, and tilt configurations affect aerodynamic efficiency, thrust output, and structural reliability. A parametric analysis was conducted using Computer-Aided Design (CAD) and Computational Fluid Dynamics (CFD) simulations in ANSYS Fluent, evaluating parameters such as blade twist, pitch, aspect ratio, and tilt variation. Mechanical robustness under dynamic loads was further investigated through Finite Element Analysis (FEA). Experimental validation was performed with a custom-built test rig to measure thrust and power requirements for both static and tilted configurations. Different materials, including glass fiber, carbon fiber, and nylon, were assessed for their strength-to-weight ratio and aerodynamic suitability. The findings contribute to improving UAV propeller design for greater efficiency and stability in agricultural applications.

Keywords: Drone blade, CFD, ANSYS, Drag force, Tilting angle, etc.

Review Paper on Rolling Element Bearing Daignostics

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Abstract;

Rolling element bearings are basic elements in rotating equipment, providing smooth movement and safe load transfer with a reduction in friction. They are also one of the most failure-oriented components, and their failure may result in substantial machine damage, expensive downtime, and safety hazards. To overcome this, considerable effort has been directed towards bearing health diagnostics and prognostics. Historically, methods depended largely on the analysis of vibration signals, but limitations posed by noise interference, varying operating conditions, and low fault signatures restricted their performance. The development of more advanced signal processing methods—wavelet transforms, envelope detection, and spectral kurtosis—has improved fault detection, while computational modeling has refined knowledge of bearing dynamics. More recently, machine learning and artificial intelligence have revolutionized the discipline by facilitating automated fault classification and predictive maintenance planning. Benchmark datasets, such as the Case Western Reserve University (CWRU) dataset, have been instrumental, although problems with standardization and variability of signals persist. This review brings together the advances in diagnostic techniques, applications of various bearing types, and benefits and challenges of existing practices. It also emphasizes the use of smart sensors, IoT, emerging materials, and digital twin technologies as directions of the future. By recognizing major challenges—i.e., early fault detection, lack of datasets, and cost efficient monitoring—this paper gives insights to lead both practitioners and researchers toward more trustworthy, intelligent, and eco-friendly bearing health management systems.

Keywords: Rolling element bearings, Fault diagnosis, Vibration analysis, Condition monitoring, Predictive maintenance

Optimization of turning of Al7075 nanocomposites under compressed air-cooling using TOPSIS approach

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Abstract: This study presents a multi-objective optimization of cutting parameters for the turning of Al7075-based hybrid nanocomposites under compressed air-cooling conditions using the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS). Nine distinct composite specimens, fabricated via stir casting with varying proportions of SiC and graphene reinforcements, were machined on a CNC lathe using PVD-coated carbide inserts. Machining performance was evaluated in terms of surface roughness (Ra), cutting force (Fc), and tool flank wear (VB), with all responses targeted for minimization to enhance surface integrity, reduce energy consumption, and extend tool life. An experimental design including 81 trials across three levels of cutting speed (v), feed rate (f), and depth of cut (d) was implemented under both dry and compressed air conditions. The TOPSIS approach was employed to normalize and weight the criteria, determine positive (PIS) and negative (NIS) ideal solutions, and compute closeness coefficients for ranking the alternatives. The optimal parameter set under compressed air cooling was identified as a $V = 150$ m/min, $f = 0.30$ mm/rev, and $d = 0.5$ mm, yielding $Ra = 0.81$ μm , $Fc = 51$ N, and $VB = 112$ μm which is also validated through the confirmatory experiments. Results demonstrate that compressed air cooling significantly improves machinability over dry cutting, and that the TOPSIS framework provides a transparent, reproducible, and effective decision-making tool for balancing multiple performance measures in the machining of advanced hybrid nanocomposites.

Keywords: TOPSIS, Optimization, Compressed air, Surface roughness, Cutting forces, Flank wear

AI-Based Arc Fault Detection in Electrical Distribution Systems

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Abstract: Electrical arc faults are a significant cause of fires and system failures in low-voltage distribution networks, especially in environments where PVC-insulated wiring is widely used. Traditional protective devices such as fuses and circuit breakers are often incapable of detecting such faults due to their intermittent and low-current nature. This limitation poses serious safety risks in residential, industrial, and commercial installations. The proposed project aims to develop a low-cost, AI-based arc fault detection system specifically tailored for PVC wire-based systems. The solution integrates current and voltage sensors with a microcontroller that collects real-time signal data, which is then analyzed using machine learning models trained to recognize the unique characteristics of arc faults. The system will be simulated using MATLAB and Proteus software and later implemented in hardware for validation. It is designed to trigger immediate alerts upon detecting fault conditions, significantly reducing the risk of fire and system damage. The expected outcome is an intelligent, adaptable, and efficient protection system that enhances electrical safety, especially in aging or overloaded PVC wiring networks.

Keywords: Arc Fault, AI, Machine Learning, Electrical Safety

Smart PLC controlled milk dispensing system with precision flow measurement for small scale dairy farms

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Abstract:

Many people around the globe drink dairy drinks frequently; therefore, it is crucial to ensure they store these items correctly in order to preserve their freshness and amount effectively. Manual milk collection in small dairy operations frequently results in inaccuracies, spills, and sanitary issues, ultimately impacting producer earnings and customer confidence. This study introduces an innovative system for managing milk supplies using PLCs equipped with precise fluid measurements, aiming to resolve identified problems through its development and execution. Automated systems guarantee meticulous control over milk deliveries while reducing mistakes due to technology's precision and ensuring cleanliness via automated processes. The system maintains constant surveillance over variables like flow rate and quantity, alongside coordinating actions of valves, pumps, and dosing mechanisms through its Programmable Logic Controller. It enables reliable procurement logistics while minimizing waste and improving operational visibility. A suggested approach ensures reliability, offers economic efficiency, and caters specifically to smaller farming enterprises frequently deprived of pricey automation options. Empirical evaluation shows that this system yields dependable, precise readings for critical attributes, thereby enhancing performance metrics. Moreover, this measure enhances clearer sight during milk transport and boosts trust customers have in food security and uniformity of products. Through decreasing expenses related to operations and improving how milk is managed locally, this strategy equips farmers with advanced equipment necessary to supply premium dairy goods meeting current market demands. This system significantly boosts efficiency while guaranteeing environmental friendliness and competitive advantage for microdairy operations worldwide.\

Keywords: PLC-based automation, Dairy supply system, Fluid quantification First Section

AI-Enabled Smart Grid-Connected Solar Inverter with IoT- Based Fault Detection and Load Forecasting

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Abstract: The rapid integration of renewable energy into modern grids demands advanced control, monitoring, and predictive capabilities. Conventional solar inverters suffer from delayed fault detection, rigid control logic, and limited forecasting ability [7],[9]. This paper presents an AI-enabled smart grid-connected solar inverter with IoT-based fault detection and load forecasting. An ESP32 microcontroller acquires real-time data from IoT sensors (voltage, current, temperature, vibration) and transmits it to cloud platforms for storage and visualization [1],[11]. Advanced AI algorithms—Isolation Forest for anomaly detection (achieving >95% detection accuracy with <2s response time) [14] and Long Short-Term Memory (LSTM) networks for short-term load forecasting (with Mean Absolute Percentage Error <6%) [5],[12]—enable intelligent decision-making. IoT dashboards (Grafana, Blynk) ensure real-time monitoring [11], while maximum power point tracking (MPPT) with a boost converter improves energy harvesting efficiency [10]. Simulation results validate the system's performance, achieving maximum PV power of 160 W at 35 V, a charging current of 3.17 A, and inverter efficiency of ~92% [6]. The novelty of this work lies in combining real-time IoT sensing with AI-driven predictive analytics in a scalable architecture, moving beyond conventional monitoring toward intelligent and autonomous renewable energy management. Future extensions include hardware prototyping and field testing to validate real-world reliability [15].

Keywords: Smart Grid, Solar Inverter, Artificial Intelligence (AI), Internet of Things (IoT), Fault Detection, Load Forecasting, Maximum Power Point Tracking (MPPT), Renewable Energy, Energy Efficiency.

Design and Implementation of a Low-Cost Power Line Inspection Robot

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Abstract: The maintenance of electrical transmission lines is a critical task to ensure uninterrupted power delivery. Conventional inspection and cleaning methods are labour intensive, costly, and pose significant safety risks to workers. To address these challenges, this project proposes the design and development of a low-cost power line inspection robot capable of both monitoring and cleaning transmission lines. The system is equipped with an ESP32-CAM module for real-time video surveillance, enabling continuous monitoring of the transmission line condition. A compact cleaning mechanism is integrated to remove dust, debris, and other minor contaminants from the line surface. The robot is designed to be lightweight, economical, and capable of traversing the line autonomously, thereby reducing manual intervention. By combining IoT-based monitoring with a mechanized cleaning process, the proposed system offers a safe, efficient, and affordable solution for transmission line maintenance. This project contributes to enhancing the reliability of power delivery infrastructure while minimizing costs and operational hazards.

Keywords: ESP32-CAM, Transmission Line Maintenance, Autonomous Cleaning Mechanism.

GSM-Based Remote Energy Meter with Load Control and Mobile Billing

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Abstract: This paper, a GSM-based remote energy meter with load control and mobile billing features is presented as a complete solution for smart energy management. The suggested system provides appliance-level consumption statistics using the ESP32 microcontroller and Non-Intrusive Load Monitoring (NILM) algorithms, empowering consumers to make knowledgeable decisions regarding their electricity use. Through a userfriendly mobile application, the energy meter's two-way connection enables remote electrical load monitoring and control. This feature optimizes energy use, lowers expenses, and enhances grid stability for both utilities and consumers. With an 89% identification rate for large appliances and dependable real-time mobile billing updates, the design places a high priority on accuracy and affordability. Effective load control, precise consumption tracking, and substantial potential for lowering energy waste are demonstrated by simulations and prototype testing. Future improvements like scalability, advanced security measures, and integration of renewable energy sources are made possible by the modular architecture. This GSM-enabled meter is a major advancement in the modernization of power systems since it gives end customers comprehensive insights into their energy profile and gives utilities smart demand response tools. The system is ideal for both residential and business settings due to its scalability, affordability, and ease of deployment

Keywords: Smart meter, NILM, ESP32, Load management, GSM, Appliance recognition, Energy monitoring

PLC Based Material Sorting System

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Abstract: In the era of Industry 4.0 and smart automation, the automation of waste segregation has become essential for enhancing recycling efficiency and minimizing human involvement. This work presents a PLC-controlled material sorting system designed to classify and segregate objects based on multiple attributes, namely metallic/non-metallic, wet/dry, and black/white. The proposed system integrates different types of sensors—inductive proximity sensors for metal detection, moisture sensors for liquid content identification, and optical reflective sensors for color differentiation. Sensor outputs are processed by a Programmable Logic Controller (PLC), which executes real-time decisionmaking and actuates a sorting mechanism such as motorized diverters or pneumatic drives to direct materials into designated bins. The system demonstrates improved sorting speed, accuracy, and reliability compared to manual methods, thereby supporting sustainable recycling practices. Beyond waste management, the approach can be extended to industrial packaging and material-handling applications, contributing to scalable, sensor-driven automation solutions aligned with modern industrial requirements.

Keywords: Programmable Logic Controller, Material Sorting System, Smart Waste Management, Ind. 4.0.

Floating Capacitor Integrated DAB for Wireless Charging Application

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Abstract: This paper presents a novel single-phase AC–DC converter topology, the Floating Capacitor Integrated Dual Active Bridge (FCI-DAB), designed to enhance power density, efficiency, and reliability in wireless charging and other power electronic applications. Conventional AC–DC converters depend on bulky electrolytic capacitors to mitigate double-line-frequency ripple, but these components increase system size, losses, and thermal stress, limiting lifetime and energy efficiency. The proposed FCI-DAB addresses these drawbacks by integrating an active ripple power decoupling stage with a floating capacitor directly into the high-frequency link of a Dual Active Bridge converter. This approach eliminates the need for large DC bus capacitors, enabling the use of compact and long-lasting film or ceramic capacitors while significantly reducing secondary RMS current and conduction losses. A duty-cycle modulation control strategy is employed to achieve near-unity power factor ($PF \approx 0.99$) and stable DC output with effective ripple suppression. Experimental validation on a 1.5 kW GaN-based prototype demonstrates high performance with 93% efficiency, improved thermal management, and compact design. The FCI-DAB concept offers a practical, space-efficient, and reliable alternative to traditional two-stage and single-stage AC–DC converters, particularly suited for wireless EV charging and renewable energy systems.[7], [10]

Inverter Switch Fault Diagnosis System for BLDC Motor Drives

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Abstract: Brushless DC (BLDC) motors are commonly used in industrial applications due to their simplicity and reliability. However, the reliable operation of the BLDC motor mostly depends on the proper functioning of the inverter switches. In industries, troubleshooting inverter faults can be challenging without an appropriate system of diagnosis. This paper presents a fault diagnosis system designed for detecting open circuit switch faults in a phase voltage source inverter (VSI) that powers and controls a BLDC motor. The proposed fault diagnosis system enables the detection and identification of faults in voltage source inverter (VSI) switches. Fault diagnosis is based on the Discrete Fourier Transform (DFT) analysis of the BLDC motor line voltage. DFT analysis demonstrates that the proposed system provides high observability of inverter switch state, supports systematic fault injection and enables quick automated fault isolation. The simulation results show that the proposed approach accurately detects and limits inverter switch faults with minimum lag. The effectiveness of the system is validated through both simulation and experimental setup. This diagnosis framework improves the reliability and safety of BLDC motor drives under real-time operating conditions.

Keywords: BLDC Motors, Inverter switch faults, Discrete Fourier Transform analysis, fault diagnosis system.

Voltage Regulation of KY Converter Using PI Controller

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Abstract:

DC–DC converters are essential in power electronics for efficient power conversion and voltage regulation in applications such as renewable energy systems, electric vehicles, and portable devices. Conventional converters like buck and boost suffer from discontinuous currents and limited gain. The KY converter addresses these issues with continuous input and output currents and positive output voltage, making it suitable for step-up applications. This paper presents the design and implementation of a PI controller for voltage regulation of the KY converter. Through mathematical modelling and MATLAB-based simulation, the PI controller demonstrates stable performance, including voltage of 20 V from 12 V input, reduced overshoot from 2 V to 0.5 V, faster settling time from 1.5 ms to 0.5 ms, and better load regulation with undershoot of 0.3 V during load changes.

Keywords: KY Converter, PI Controller, Voltage Regulation, DC–DC Converter, Power Electronics.

Automatic Monitoring and Protection of Machines By Using PLC & SCADA

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Abstract:

In modern industries, ensuring reliable machine performance is essential to reducing downtime, lowering maintenance costs, and improving operational safety. As Industry 4.0 develops, advanced automation technologies like as Supervisory Control and Data Acquisition (SCADA) systems and Programmable Logic Controllers (PLC) are widely used for intelligent protection and real-time monitoring. This paper presents an autonomous monitoring and protection system that continuously measures current, voltage, temperature, vibration, and motor velocity using sensors and PLC-SCADA. While SCADA provides viewing, alarm triggering, and historical data storage, the PLC evaluates these parameters against predetermined safety limits and takes corrective action. Both simulated and real-world scenarios, including as overload, overvoltage, extreme heat, and odd vibrations, were used to validate the system. According to experimental results, errors can be found in 1.5–2.2 seconds using an accuracy of 96.9–98.5%, leading to a downtime decrease of up to 45% as compared to typical relay-based systems. A comparative comparison of conventional and IoT-based prediction models indicates quicker reactions, fewer false alarms, and increased reliability. The suggested PLC–SCADA system improves equipment longevity, saves expenses, and assists predictive maintenance plans by combining automated safeguards with real-time analytics. This study underlines its importance for smart manufacturing employing IoT and sustainable operations in Industry 4.0.

Keywords: Industry 4.0, IoT, PLC, SCADA, Machine Monitoring, and Predictive Maintenance.

Control And Monitoring of Electrical Drive for EV Applications

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Abstract:

Electric vehicles (EVs) are increasingly recognized as sustainable alternatives to conventional transportation, driven by the demand for reduced emissions and higher energy efficiency. At the core of EV performance lies the electrical drive system, with the Brushless DC (BLDC) hub motor widely adopted for its high efficiency, compact design, and smooth torque delivery. To achieve optimal performance, precise control and continuous monitoring are crucial. This project employs a Proportional-Integral-Derivative (PID) controller to regulate the speed and torque of the BLDC hub motor, ensuring consistent stability under varying loads and road conditions. Alongside control, the system integrates real-time monitoring of key motor parameters such as speed, voltage, current, and temperature. These features enable early fault detection and provide protection against overcurrent, overheating, and voltage fluctuations, thereby improving safety and reliability. The system is implemented on a microcontroller-based platform that executes the PID algorithm, interfaces with sensors, and displays data through an LCD. Advanced communication protocols ensure seamless integration with the vehicle management system, supporting adaptive control and predictive maintenance. The modular design further allows scalability across multiple EV platforms. By combining intelligent control, effective monitoring, and robust protection features, the proposed system enhances driving comfort, energy efficiency, and long-term operational dependability in electric vehicles.

Keywords: Closed Loop Control, Brushless DC Hub Motor, Adaptive Control, Vehicle Management System, Proportional Integral Derivative Controller

Design and Implementation of a Closed-Loop Buck-Boost Converter for EV Application

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Abstract: Electric vehicles (EVs) need robust and efficient DC–DC converters for the purpose of delivering stable power to key subsystems including motor drives, control circuits, and auxiliary devices. Because the native battery voltage of EVs varies with changes in load and state of charge, a converter that is capable of stabilizing and regulating this voltage is needed. In this work, the analytical design, simulation, and experimental test of a buck–boost converter with a PID controller are shown. The converter was analytically designed according to EV power needs and was simulated using MATLAB/Simulink, and its performance was evaluated in both open-loop and closed-loop operations. The open-loop response showed shortcomings like poor voltage regulation, visible ripple, and reduced transient response, highlighting the insufficiency of uncompensated operation to fulfill rigorous EV power requirements. A PID-based closed-loop control method was therefore used to compensate for these shortcomings, which ensured excellent voltage regulation, reduced output ripple, and enhanced transient response during dynamic load situations. The use of closed-loop PID control not only increased stability but enhanced overall efficiency, making the system robust and reliable for real-world EV applications. The results confirm the versatility of the PID-controlled buck–boost converter as a cost-effective, energy-saving solution for advanced electric vehicles, providing consistent operation, improved usage of stored energy, and versatility to meet the increased demand for sustainable transportation technology.

Keywords: Electric Vehicle (EV), Buck–Boost Converter, PID Controller, DC–DC Power

Design, Manufacturing & Testing of Composite Bricks Using Bagasse Ash, Bamboo Fibers and Lime Stone

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Abstract: This study focuses on the development of eco-friendly and sustainable composite bricks using a combination of bagasse ash, bamboo fibers, and limestone as partial replacements for conventional materials. The main objective of this research is to utilize agricultural and industrial waste products in brick manufacturing to reduce environmental pollution and promote green construction practices. Four distinct groups of brick samples were prepared with varying proportions of bamboo fiber content 0%, 5%, 10%, and 15% while maintaining a constant mix ratio of bagasse ash and limestone. These samples were tested under controlled laboratory conditions to determine their compressive strength, density, and overall mechanical performance. The results revealed a noticeable improvement in compressive strength with the addition of bamboo fibers, with the highest strength recorded at 10% fiber content. Beyond this percentage, a slight decrease in performance was observed due to fiber agglomeration and reduced bonding. Furthermore, the study compared the weight and physical appearance of each sample, indicating that the inclusion of fibers slightly reduced the weight, enhancing handling efficiency. Overall, the findings highlight that bamboo fiber-reinforced bricks not only meet the requirements for general masonry applications but also present a sustainable alternative to traditional clay bricks, contributing to eco-friendly construction and waste utilization. **Keywords:** Bagasse Ash, Bamboo Fibers, Composite Bricks, Nano Carbon, Sustainable Construction,

Mathematical Modeling of Hole Diameter Error and Analysis of the Effect of Machining Factors in Flood Coolant Drilling using RSM and Minitab

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Abstract:

In order to analyze hole diameter inaccuracy and assess the impact of machining factors such spindle speed, feed rate, and peck depth during flood coolant drilling of EN9 carbon steel, this work proposes a mathematical model. Response Surface Methodology (RSM) with Central Composite Design (CCD) was used to design the experiments, which were then carried out on a VMC system. Using Minitab software, regression analysis and ANOVA were used to examine the impact of process factors on the accuracy of the hole diameter. According to the study, spindle speed has a minor impact on the hole diameter error, but feed rate and peck depth have a substantial impact. The created models may be used as a tool to optimize drilling operations in comparable circumstances and offer an accurate prediction of hole diameter error.

Keywords: Flood coolant drilling, Response Surface Methodology (RSM), EN9 Steel, Hole Diameter Error, Machining Parameters, ANOVA,

A Deep Learning-Based Sentiment Analysis Framework for Social Media and YouTube Comment Mining

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Abstract:

This study introduces a novel sentiment analysis framework combining stacked SimpleRNN layers with extensive preprocessing to classify social media text, specifically YouTube comments, into positive and negative sentiments. Unlike prior works, our model integrates diverse sentiment-labeled datasets and applies a streamlined architecture optimized for both accuracy and generalization. Achieving 98.5AUC of 0.99, the approach addresses class imbalance challenges and demonstrates robust real-time applicability for content recommendation. Visual analyses confirm stable training and effective sentiment discrimination, while the integration with a video-comment fetching pipeline enables actionable insights for content creators. This work bridges the gap between high performance sentiment classification and practical deployment, advancing sentiment analysis towards scalable, domain adaptive social media applications.

Keywords: Sentiment Analysis, Simple RNN, Social Media, Real-Time Deployment

Advance Driver Monitoring System [ADMS]

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Abstract: The Advanced Driver Monitoring System (ADMS) addresses critical road safety concerns caused by driver fatigue, distraction, and seat belt non-compliance, Utilizing a Raspberry Pi as the central processing unit, the system integrates real-time image processing and machine learning algorithms to monitor driver behavior. Key features include drowsiness detection through Eye Aspect Ratio (EAR), face recognition for driver presence, and seat belt verification via visual cues and CAN bus data. The integration of the vehicle's Controller Area Network (CAN) bus allows seamless communication with electronic control units (ECUs), enabling automated safety interventions such as alarms and vehicle speed control. Literature review highlights the limitations of existing systems, including poor real-time accuracy and insufficient vehicle integration, emphasizing the need for comprehensive solution. The ADMS methodology combines hardware setup with software algorithms for continuous monitoring, ensuring prompt detection of unsafe driving conditions. Experimental results demonstrate the system's potential, though some model training challenges persist. Overall, the ADMS offers a scalable, cost-effective, and robust approach to enhancing driver safety and compliance, aiming to reduce accidents caused by human error. This integrated solution supports smarter transportation by promoting safer driving habits, proactive interventions, and data-driven fleet management, contributing significantly to reducing road traffic injuries and fatalities. a

Keywords: Driver Monitoring, Drowsiness Detection, Seat Belt Verification, Raspberry Pi, CAN Bus Integration, Road Safety

Causality Enabled Ontology Mapping

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Abstract : In this current era of the data revolution, integrating and analyzing data from several sources is of great importance. The term ontology, which describes the formal description of concepts and their relationships, helps to integrate and analyze data from many sources, as well as to automate the reasoning of concepts and relationships. With an ontology mapping, links between entities across multiple ontologies can be established. In order to properly utilize ontologies, a more thorough investigation of the causal relationships among the entities in an ontology is necessary. In this research, we offer a unique ontology mapping method that uses a similarity score-based approach to achieve inter-class ontology mapping (the mapping across ontologies). The scores are modified based on the causal relationships found in the given ontologies. It has been noted that the suggested mapping method, which makes use of intra-ontology causal links, contributes to the ontology mapping's increased accuracy. We used two different data sets to demonstrate the value of this approach. We found that it effectively modifies how knowledge is represented and the mapping that results can be utilized to improve support for decision-making and data integration. Furthermore, the causal relationships in an ontology can make it possible to use the causal inferencing method for additional processing in subsequent tasks.

Keywords: Ontology Alignment, Causal Discovery, Inter class Ontology, PC algorithm
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Bhutan's Sustainable Development: A Conceptual Study Based on Secondary Sources

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Abstract: Sustainable development has become a global priority in the 21st century, balancing economic growth, environmental protection, and social equity. Bhutan, a small Himalayan kingdom, presents a unique development model rooted in the philosophy of Gross National Happiness (GNH), which emphasizes holistic wellbeing over mere economic advancement. Unlike many countries that prioritize GDP growth, Bhutan's sustainable development integrates cultural preservation, environmental conservation, and equitable social progress.

Keywords: Gross National Happiness (GNH), Sustainable Development, Environmental Conservation, Bhutan, Socio-economic Development.

A Study of Muslim Women's Participation in Household Financial Planning Management in Sangli District: A Systematic Review

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Abstract:

This systematic review analyzes the participation of Muslim women in household financial planning and management in Sangli District, Maharashtra (India), utilizing 40 recent studies (2020–2025). We integrate insights from four innovation domains: digital financial inclusion, Islamic microfinance models, community interventions and policy impacts, and educational and legal empowerment frameworks. Our findings indicate that, not with standing policy advancements (e.g., near-universal bank account access) and grassroots initiatives (e.g., self-help groups and Islamic microfinance), Muslim women in rural Sangli continue to encounter significant socio-cultural and structural impediments to financial agency. Patriarchal norms (purdah, restricted mobility) [1] [2], low financial literacy [3] [4], and limited legal awareness are some of the main obstacles. Digital finance and community microfinance innovations have shown promise in increasing women's economic security and ability to make decisions [5] [6], but there are still gender gaps. For instance, women are much less likely than men to use digital financial services, even when they have access [7]. We conclude with an innovative integrated framework proposing that the amalgamation of digital inclusion with culturally tailored Islamic finance, supportive community networks, and legal- educational empowerment can produce enduring enhancements. The review provides a thorough, current comprehension of the financial involvement of Muslim women in Sangli District and suggests a multi-faceted strategy to improve their financial autonomy within the household.

Keywords: Muslim women, financial inclusion, Digital finance, Islamic microfinance, Empowerment.

Integrating Lost Sales and Random Deterioration in Inventory Control Models

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Abstract: The concept of & Inventory Models with Lost Sales and Random Deterioration & addresses the real-world challenges faced by businesses in managing their inventory under conditions of uncertainty and product perish ability. Traditional inventory systems often assume that unmet demand will be backordered and that products remain in perfect condition while in storage. However, in practical scenarios, customer demands that cannot be immediately fulfilled often lead to lost sales, directly impacting revenue and customer loyalty. Simultaneously, certain products, especially in industries like food, pharmaceuticals, and fashion, are susceptible to deterioration over time due to environmental factors or shelf-life limitations. Incorporating both of these factors—lost sales and random deterioration—into inventory models creates a more realistic and dynamic system for inventory management. These models help businesses determine optimal ordering policies that minimize total inventory related costs, including holding costs, shortage or lost sales costs, and deterioration or wastage costs. By acknowledging that some inventory items will degrade and that not all customer demand can be delayed or backordered, companies can better forecast inventory needs, reduce overstocking, and avoid costly stock outs. The inclusion of probabilistic deterioration such as using exponential or Weibull distribution to model spoilage—and random demand patterns adds 2 mathematical complexity, but it significantly enhances the accuracy and applicability of these models in real business environments. Moreover, these models are essential for industries where the cost of lost sales or product expiry is high, enabling decision makers to make informed choices about order quantity, safety stock levels, and replenishment frequency. The models often employ analytical or simulation-based techniques to optimize decision-making under these constraints. Sensitivity analysis within these models also provides strategic insights into how variations in demand, deterioration rates, or lead times can influence inventory performance. Ultimately, inventory models with lost sales and random deterioration support better supply chain efficiency, customer satisfaction, and sustainable business practices by reducing waste and ensuring product availability. They serve as powerful tools for businesses striving to balance cost-efficiency with high service levels in an unpredictable market landscape.

Keywords: Inventory control, Lost sales, Random Deterioration, Perishable inventory, Stochastic demand, Partial backordering, Exponential Deterioration and Weibull distribution.

Equity in Hybrid Work: Bridging the gap between Remote and Office-Based Employees

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Abstract:

The rapid expansion of hybrid work models, which combine the advantages of traditional office presence with the flexibility of remote work, has completely changed the way businesses operate. This method raises important issues of justice even though it offers chances for improved work-life balance, cost savings, and access to larger talent pools. Compared to their on-site colleagues, remote workers usually report lower visibility, fewer networking opportunities, and fewer opportunities for advancement. Both engagement and inclusion may be harmed by these disparities, which are influenced by things like proximity bias and inconsistent policies. This study examines the body of re-search on equity in hybrid work, emphasizing prevalent issues like disparities in recognition, obstacles to collaboration, and unequal access to resources. It also covers practical strategies that businesses can use, such as technology-driven collaboration tools, inclusive leadership, and outcome-based performance metrics. The study concludes by making the case that reducing these equity gaps is essential for maintaining productivity, trust, and organizational resilience in the workplace of the future, in addition to being fair and promoting well-being.

Keywords: Hybrid work, workplace equity, remote employees, office-based employees, employee inclusion, performance evaluation, organizational fairness.

Cross Learning Opportunities between Services and Manufacturing Innovation

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Abstract: Innovation has emerged as a cornerstone of competitiveness, growth, and sustainability across both services and manufacturing sectors. Traditionally, manufacturing has been driven by structured R D, prototyping, and process optimization, while services have focused on agility, co-creation, and customer-centric models. However, with the advent of digital technologies such as AI, IoT, and automation, along with growing sustainability imperatives, the boundaries between these two paradigms are increasingly converging. This study undertakes a comparative analysis of innovation drivers, processes, and outcomes across the two sectors, relying on secondary data from scholarly literature, industry reports, and global databases. The proposed framework highlights key similarities and differences: while service innovation emphasizes customer experience and responsiveness, manufacturing innovation prioritizes product performance and efficiency. Both, however, are influenced by customer demand, technological adoption, and regulatory pressures. The study demonstrates significant potential for cross-learning, where services can benefit from manufacturing's structured R D, and manufacturing can adopt service-oriented approaches such as customer co-creation and agile design. Digital transformation and sustainability emerge as shared forces, reshaping innovation trajectories and enabling convergence. The findings offer theoretical, managerial, and policy implications, underscoring the need for collaborative innovation ecosystems that integrate economic growth with social and environmental responsibility.

Keywords: Innovation, Services Sector, Manufacturing Sector, Digital Transformation, Sustainability

A Research Paper on How Gen Z Shops with AI: Adoption, Trust and Purchase Outcomes – An Empirical Study

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Abstract:

Artificial intelligence (AI) is reshaping e-commerce by influencing how consumers search, evaluate, and purchase products. This study focuses on Generation Z, a digital native cohort that frequently interacts with AI tools such as recommendation engines, chatbots, and augmented reality. Using survey data from 143 respondents, regression and mediation analyses examined how AI adoption impacts purchase outcomes, with trust as a mediator and privacy concerns as a moderator. Results show that AI usage significantly enhances purchase intention, satisfaction, and repurchase behavior, with trust partially mediating this effect. Privacy concerns negatively moderated the relationship, reducing AI's impact when data security issues were salient. The study contributes to adoption theory and offers practical guidance for e-commerce platforms to balance personalization with transparency and ethical data practices.

Keywords: Generation Z, Artificial Intelligence, Trust, Privacy, E-Commerce.

Exploring the Interrelationships among Quality of Work Life Dimensions: An Internal Consistency Study of Foundry Employees in Shiroli MIDC.

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Abstract:

A nation's degree of prosperity is determined by the quality of its human capital. Businesses in the twenty-first century realize that they have a competitive edge above competitors' products or technology alone because of the unique knowledge, skills, and experience of their personnel. Economist Arthur Lewis made the poignant observation that "there are great differences in development between countries which seem to have roughly equal resources." This highlights how crucial worker well-being is to the nation's prosperity. When people face challenges at work or at home, their psychological well-being might suffer, impacting both their personal and professional life.

Key words: work environment, employee satisfaction, work life quality, and cultural development

**Literature Review: Consumer Engagement in the Digital Age:
A Review of Literature on Retailers Marketing Strategies**

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Abstract:

This reviewing process compiles 40 significant studies (T1–T40) to examine how digital marketing strategies impact consumer engagement in small retailers. Abrand engagement remains the focus of social media marketing (T1, T6, T19) and personalized content (T5, T21), whereas email campaigns (T7, T17) and SEO (T2, T8) showcase low-cost methods of driving traffic and conversions. Micro-influencer partnerships (T3, T9, T33) outpace macro-influencers yielding 45% higher engagement (T3). But small retailers have limitations such as a limited budget (T11, T34), technical deficiencies (T4, T20), and algorithms that change rapidly (T1, T12). Some studies find deficits in long-term empirical data (T40), for example, about the sustainability of influencer marketing (T33) or the influence of macroeconomic changes (T25). The review highlights the importance of assertive tactics, such as analytics powered by AI (T20), omnichannel strategies (T28), and search engine optimization focused on local (T8). While there is a well-documented literature on the short-term benefits (T2, T7, T22), there is a scarcity of longitudinal studies on, for example customer lifetime value (T40) or on the data privacy concerns (T29, T39). Research has also highlighted a need to find a middle ground with a balanced digital approach even if somewhat expensive that promotes interactivity, personalization, and ethics (T23, T39) to avoid barriers for sustained engagement. Little research has been applied immediately before the pandemic related to the concerned and relevant topics like SME resiliency (T25) and cross-sectored cultural dynamics in digital adjustments (T32) focused on changing consumer attention.

Keywords: Digital marketing, consumer engagement, small retailers, social media, influencer marketing, SEO, email campaigns. First Section

Automatic Multi-Recipe Chemical Mixing and Auto-Cleaning System Using PLC

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Abstract:

Accurate and hygienic chemical mixing is essential in industries such as pharmaceuticals, food processing, and chemicals. Conventional mixing systems are generally restricted to a single recipe, requiring manual reprogramming or adjustments for any changes. This leads to significant downtime, operational inefficiencies, and risks of contamination due to the absence of cleaning automation. To overcome these limitations, this paper proposes a Automatic Multi-Recipe Chemical Mixing and Auto-Cleaning system using PLC. The system utilizes a Siemens LOGO PLC to store multiple recipes, each with predefined pump and mixer timings. Operators can select the required recipe through push buttons or an HMI without the need for reprogramming. An integrated auto-cleaning cycle is implemented to flush the system after mixing, ensuring hygiene and reducing cross-contamination between batches. The methodology involves ladder logic programming, simulation using LOGO Soft Comfort software, and hardware prototyping with pumps, solenoid valves, and mixer motors. Expected outcomes include increased flexibility, improved cleanliness, reduced downtime, and enhanced productivity at an affordable cost. This work contributes a compact and reliable automation model suitable for small and medium-scale industries while offering potential for future enhancements such as IoT integration, advanced recipe storage, and sensor-based cleaning validation.

Keywords: PLC-Based Automation, Multi-Recipe Chemical Mixing, Auto- Cleaning System, Siemens LOGO PLC, Industrial Process Control, Automation in Chemical Industries

Sustainable Vegetable Marketing Models: Farmer-to-Consumer Practices among Farmer-Producer Companies in Pune District

Mr. Ganesh A. Abhale and Dr. Sandeep N. Jagdale

Abstract:

Sustainable agricultural marketing plays a vital role in enhancing farmer incomes, ensuring consumer access to fresh produce, and strengthening local food systems. In India, Farmer-Producer Companies (FPCs) have emerged as a collective institutional model to empower smallholder farmers and reduce the dominance of intermediaries in vegetable marketing. This study examines the farmer-to-consumer vegetable marketing practices of FPCs in Pune district, with a focus on sustainability, efficiency, and inclusivity. Using a mixed-method approach, primary data were collected from farmer-members, FPC managers, and consumers through structured surveys and interviews. The study evaluates different marketing models adopted by FPCs, including direct sales through farmer markets, retail outlets, and digital platforms, and compares them with traditional wholesale systems. Findings suggest that FPC-led marketing channels enhance price realization for farmers (15–25% higher than conventional markets), improve consumer trust in food quality, and contribute to local economic sustainability. However, challenges remain in terms of infrastructure, scale of operations, and digital adoption. The paper argues that strengthening FPCs through supportive policies, market linkages, and capacity-building is essential for scaling sustainable farmer-to-consumer models. The insights from Pune district provide valuable lessons for replicating such approaches in other regions, contributing to India's progress towards Sustainable Development Goals (SDG 2, SDG 8, and SDG 12).

Keywords: Farmer-Producer Companies, Vegetable Marketing, Sustainability, Farmer-to-Consumer, Pune District, Agricultural Marketing.

A Comprehensive Analytical Investigation into the Opportunities, Constraints, and Socio-Economic Implications of Women Entrepreneurs Engaged in Agri-Tourism: Evidence from Pune District, Maharashtra

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Abstract:

Agri-tourism, an integrative approach combining agricultural production with tourism services, has surfaced as a significant catalyst for socio-economic advancement in rural India. This study presents a detailed empirical analysis of the opportunities, constraints, and resultant socio-economic implications for women entrepreneurs operating within the agri-tourism sector of Pune District, Maharashtra. Employing a mixed-methods research design, quantitative data were gathered from 300 registered women-led agri-tourism units across Maharashtra via structured questionnaires, supplemented by qualitative insights from 20 semi-structured interviews with domain experts and stakeholders. Key findings indicate that agri-tourism offers substantial opportunities for women, including income diversification, skill enhancement, social recognition, cultural preservation, and community networking. However, significant impediments such as limited access to capital, deficits in managerial and marketing expertise, and pervasive sociocultural barriers curtail their entrepreneurial potential. The study conclusively demonstrates that active participation in agri-tourism leads to enhanced household income, elevated social status, and greater community engagement. The paper culminates in evidence-based policy recommendations, advocating for targeted capacity-building initiatives, improved financial facilitation, robust policy support, and community sensitization programs. This research contributes to the academic discourse on gender-inclusive rural development and provides actionable insights for policymakers, development agencies, and local communities to harness agri-tourism as a vehicle for sustainable empowerment and economic growth.

Keywords: Women Entrepreneurs, Agri-Tourism, Rural Development, Socio-Economic Impact, Empowerment, Constraints.

The Impact of Mergers and Acquisitions: A Comprehensive Review of Theoretical and Empirical Evidence

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Abstract: Mergers and acquisitions (M&A) have become a dominant strategy for corporate growth and market expansion in an increasingly globalized economy. Companies pursue these transactions to achieve economies of scale, strengthen market share, access advanced technologies, diversify risks, and improve competitive positioning. Despite the strategic importance of M&A, research findings on their actual impact remain inconclusive. While evidence frequently shows positive short-term gains for target firms' shareholders, acquiring firms often face challenges in realizing sustained financial and operational improvements. This review synthesizes theoretical frameworks, methodological approaches, and empirical studies to evaluate the economic, strategic, and organizational outcomes of M&A. By integrating insights from global literature, the paper highlights key drivers of success and failure, identifies research gaps, and provides directions for future studies on the effectiveness of mergers and acquisitions.

Keywords - Mergers and acquisitions, corporate strategy, financial performance, strategic integration

A study on examining the impact of alternative work schedule on employee health and productivity with reference to Menon and Menon Ltd.Kolhapur.

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Abstract: The study analyse the impact on non-traditional work schedules, like flexible hours, compressed workweeks, and remote work, affect employee well-being, focusing on Menon and Menon. Although, these schedules can help improve job satisfaction, reduce absenteeism, and increase productivity, they may also cause trouble sleeping, stress, and difficultly to managing personal routine. Although these methods give employees more freedom and help balance work with personal life, they also come wit challenges. These include problems like disrupted sleep patterns, 2 stress, and trouble managing personal routines. The findings show that employee well-being is closely tied to performance outcomes. Poorly organized or unstructured work schedules can lead to burnout, decreased focus, and long-term health issues. These problems can harm both individual performance and the success of the organization. The research also highlights the need for systematic scheduling practices to accompany well-being programs and strong support systems. By looking at current practices at Menon and Menon, the study offers practical suggestions to strike a balance between organizational efficiency and employee wellness. It concludes that organizations should prioritize employee health when adopting flexible scheduling models to ensure sustainable productivity and long-term success. Ultimately, the study emphasizes the need for clear workforce management policies that connect employee well-being to organizational goals.

Keywords: Alternative work schedule, Employee health, Productivity, Work–life balance, Stress, Job satisfaction and Organization performance.

A Review of Mathematical Models for Predicting Climate Change Impacts on Ecosystems: Frameworks, Applications, and Future Directions

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Abstract:

Climate change poses a profound threat to global ecosystems, altering species distributions, phenology, community structure, and biogeochemical cycles. Predicting these impacts is critical for informing mitigation and adaptation strategies. This review synthesizes the diverse suite of mathematical models employed to forecast the effects of climate change on ecosystems. We categorize models into three primary classes: (1) Correlative and Species Distribution Models (SDMs), which establish statistical relationships between species occurrences and environmental variables; (2) Process-Based Models (PBMs), which simulate ecological mechanisms such as physiology, growth, and population dynamics; and (3) Hybrid and Integrated Assessment Models (IAMs), which combine ecological and socio-economic components. For each class, we elucidate the underlying mathematical principles, strengths, and limitations, supported by key case studies. We discuss critical challenges, including scaling issues, incorporation of biotic interactions, and the treatment of uncertainty. Finally, we highlight emerging frontiers, such as the integration of remote sensing data, machine learning techniques, and complex systems approaches. This review underscores that no single model is universally superior; rather, the choice of model must be tailored to the specific research question, spatial and temporal scales, and available data. A multi-model ensemble approach is advocated to enhance the robustness of predictions and provide actionable insights for policymakers and conservationists.

Keywords: Climate Change, Ecosystem Modeling, Species Distribution Models, Process-Based Models, Dynamic Global Vegetation Models, Biogeochemical Cycles, Uncertainty, Machine Learning, Ecological Forecasting.

Impact of HR Policies on Employee Efficiency in Vishwakarma Founders (India) Pvt. Ltd.

Shiroli

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Abstract:

This study focuses on the impact of Human Resource (HR) policies on the efficiency of employees working in an organization. Employees are the backbone of every company, and the way policies are designed, communicated, and applied directly affects their work. The aim of this research is to study the present HR practices in the company and to understand how these practices influence the performance and attitude of employees. To collect information, a simple questionnaire was prepared and shared with employees at different levels. The questions were related to recruitment, training, performance appraisal, leave, salary, compensation, and other HR-related areas. The responses were carefully studied to know how employees feel about the existing policies and how satisfied they are with them. The study found that when HR policies are clear, fair, and transparent, employees feel valued, motivated, and are able to perform their work more efficiently. On the other hand, if policies are confusing, biased, or not well explained, employee motivation decreases and efficiency also reduces. The study highlights that employee opinion and satisfaction must be given importance while designing HR policies. It also provides useful suggestions to improve HR practices, which can help to increase employee efficiency and overall organizational productivity.

Keywords: Human Resource Policies, Employee Efficiency, Employee Productivity,

Comprehensive Review on Smart Waste Management and Segregation Systems

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Abstract :

This review paper summarises findings from 25 recent research papers on smart waste management and segregation systems. The hardware and software components (IoT sensors, machine learning algorithms), image-based and sensor-based segregation methods, routing and collection optimization. Key trends, challenges, and research gap are identified, and recommendations for future work (scalability, low-cost sensing, hybrid AI-IoT designs, and lifecycle assessments) are provided. Overall, this study provides a considerable view of stage of today's waste management and segregation systems. Smart waste management identifies opportunities for future innovators. The analysis reveals that Image- based classification using deep learning models consistently achieves high accuracy under controlled conditions. The review highlights need for hybrid approaches that combines multiple machine learning models. This review is presented to concise the research findings for the students and the researchers entering this field. However, challenges remain, such as large real-world database, maintenance of sensors in different environment.

Keywords: Smart bins, IoT, Machine learning, Waste management, waste monitoring

The Assessment of Advanced English Learners for Effective and Better Written English Communication

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Introduction:

Knowing English language has always been considered as a step of various significant opportunities to make career in all areas all over the world. English has not remained a foreign language in many countries and therefore, the maximum communication all over the world has been taking place in English. This leads to the thought that English undoubtedly works as a 'lingua franca' not only in the official communication but in the business world as well. There are a number of languages in the world. Some of these languages have come to the forefront and have received a tremendous significance because they are used by millions and even billions of users all over the world. There is a substantial growth in the fields like communication, tourism, trade, transportation, marketing and various types of online services. This development has forced people to learn and make use of the languages which are spoken in the maximum business and corporate fields. The people of each nation have their own language but the use of their native language often confine them from getting connected with the rest of the world. Therefore, they have to learn the second language which is widely accepted, i.e. English. English, undoubtedly has become the second language for millions and billions of people. People have their mother-tongue but it is ultimately the second language which helps them complete their communication process and get succeeded in their career. Therefore, we notice that the people of the countries like Denmark, Germany, the Netherlands, Slovenia, and Sweden in Europe and even in India do learn English as their second language. Today, the academicians need to prepare the teaching as well as learning pedagogy and a structured methodology which can be used as a ready-made tool or guide for English language learners so that not only beginners but even the advanced learners of English should be able to refer to it as a learning material. It is necessary to consider this step as a stepping stone towards sustainable growth as well as improvement in the process of English communication. While it is true that fluency and spontaneity are the essential aspects of English communication, we should accept that accuracy in both spoken and written communication is equally significant. If our target learners are the advanced learners of English, then the aspect of accuracy becomes the major part of evaluation in the communication process. Though, the academicians positively accept the errors made by English language beginners, it should be understood that having a significant mastery on English is essential. The major focus of this study is to evaluate and analyse the errors in written English made by advanced learners of English. For these learners, English is their second language because English is not the primary language of the country where the study is performed.

Judicial Decentralization and Justice-Led Development A Management Approach for Sustainable Community Growth

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Abstract:

This paper examines the Kolhapur Circuit Bench of the Bombay High Court as a case of justice-led development (JLDM) with implications for sustainable growth and inclusive governance. Positioned within the framework of Innovation, Sustainability, and Business Intelligence, the study highlights how judicial decentralization enhances social equity, community trust, and governance efficiency, all essential dimensions of sustainable development. Adopting a management perspective, the paper evaluates the Bench using the Justice-Led Development Model (JLDM), emphasizing four key dimensions: Accessibility, Timeliness, Transparency, and Societal Impact. Findings reveal that the Kolhapur Bench reduces geographical and economic barriers, strengthens institutional trust, and fosters an enabling environment for community and business activities. By linking judicial access with developmental outcomes, the study contributes to sustainability research by framing judicial institutions as drivers of social inclusion, resource efficiency, and public value creation. The paper offers policy-level insights for administrators, researchers, and development practitioners, positioning circuit benches not merely as legal entities but as critical enablers of equitable growth, sustainable governance, and regional development.

Keywords: Justice Decentralization, Social Inclusion, Community Development, Kolhapur Circuit Bench, Justice Led Development Model, Public Value, Stakeholder Engagement

Comparative Performance of Selected Natural Coagulants in Low-Cost Water Purification Models

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Abstract: This study evaluates the comparative performance of five natural coagulants—Acacia concinna, Dolichos lablab, Neem leaf powder, Papaya seed powder, and Orange peel powder—in low-cost water purification models. The coagulants were integrated into simple filtration units made from plastic bottles layered with sand, charcoal, gravel, and cotton, and tested on polluted water samples collected from the Panchaganga River, Kolhapur. Dolichos lablab and Papaya seed powder exhibited the highest turbidity reduction, while Acacia concinna was effective in COD/BOD reduction. Neem leaf powder provided antimicrobial benefits, and Orange peel powder highlighted waste utilization potential. This comparative study confirms the feasibility of natural coagulants as sustainable alternatives for safe drinking water in rural areas.

Keywords: Natural coagulants, Acacia concinna, Dolichos lablab, Neem leaf powder, Papaya seed powder, low-cost purification, sustainable water treatment

Novel Developments in Digital Printing Techniques through Integration of Intelligent Systems for Sustainable Manufacturing and Smart Product Development

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² Dr Vikas Jangra, Ph.D. Supervisor, Associate Professor, Department of Printing Tech., GJUS T Hisar.

Abstract: Digital printing techniques have arisen as a revolutionary influence throughout various fields via allowing accurate, economical, and on-demand production of complex products. Modern developments within this particular domain have seen the merging of smart systems like artificial intelligence, machine learning, Internet of Things, and digital simulations, driving the transformation in the direction of sustainable production and smart product development. This analysis examines the convergence of digital printing technologies with smart systems, concentrating on its roles to green productivity, design flexibility, instantaneous monitoring, and flexible production approaches. Digital printing recently exceeds conventional 2D models, expanding into smart 3D printing or additive manufacturing techniques that permit fast modeling, large-scale customization, and limited material waste. Combining these technologies with artificial intelligence and machine learning supports smart planning in design improvement, defect estimation, and operation management. For example, AI-based models can examine print quality in instantaneous, modifying variables to maintain high consistency and reliability. Sustainability is a key concern in today's production, and digital printing provides significant benefits in this discipline. Minimized energy consumption, and use of compostable or recyclable substances is essential facilitators for Sustainable production. IoT-enabled systems in addition improve sustainability via offering information into resource consumption, energy effectiveness, and lifecycle analysis in instantaneous. This paper offers a detailed study of the ongoing advancements in digital printing, the combination of intelligent systems, and its outcomes for sustainable and smart production. It also emphasizes the difficulties and upcoming directions required for the broad acceptance of these technologies across industrial systems.

Process of E-filing of ITR1 and Benefits from old tax regime to new tax regime for Taxpayers from Kolhapur

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Abstract: The present study focuses on the process of e-filing of Income Tax Return (ITR-1) and a comparative analysis of the old and new tax regimes introduced by the Income Tax Department, Government of India. The e-filing facility has transformed the traditional return filing system by making the procedure faster, more transparent, and user-friendly, especially for individual salaried taxpayers. The main objective of this research is to understand taxpayers' experiences with e-filing and to evaluate which tax regime is more beneficial under different circumstances. The study is based on both primary data, collected through structured surveys of individual taxpayers, and secondary data from government websites, reports, and published studies. The findings reveal that most respondents view e-filing as a convenient and time-saving method, but challenges such as lack of awareness, technical difficulties, and limited digital knowledge still act as barriers for some taxpayers. In terms of tax regimes, the results indicate that the old regime continues to be advantageous for taxpayers with higher levels of investment and multiple deductions, while the new regime is simpler, less time consuming, and suitable for individuals with minimal tax-saving options.

Keywords: Income tax, ITR 1, Old tax regime, New tax regime, Salaried.

Experimental Assessment of Bond Behavior and Structural Performance of High-Strength Concrete Beam-Column Joints under Static Load

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Abstract: This study explores the bond characteristics and structural behavior of reinforced concrete (RC) beam-column joints constructed with High Performance Concrete under static loading conditions. Beam-column joints are critical structural elements whose failure can compromise the entire frame integrity, especially during seismic events. Twelve specimens, including L- and T-shaped configurations with M30 and M60 concrete grades, were fabricated and assessed. The investigation focused on reinforcement detailing, development length provisions, and HPC's influence on load-displacement responses. Findings demonstrate that HPC enhances joint strength, reduces deflections, and improves ductility compared to conventional concrete. Particularly, T-section joints with M60 HPC achieved superior load capacity and lower deflections. Incorporating development length in L-section joints raised strength and decreased deflections by over 20%. Numerical simulations using ANSYS closely matched experimental data, confirming the reliability of the computational model. These results support the use of HPC in beam-column joints for improved performance in high-rise and earthquake-resilient structures.

Keywords: High Performance Concrete, beam column joint, static loading, reinforcement detailing, ANSYS simulation.

Blockchain in Cloud Computing: From Theoretical Promise to Practical Scalability and Future-Proofing

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Abstract: Cloud computing and blockchain technology have emerged as two of the most disruptive forces in modern IT. Their convergence holds the promise of revolutionizing data security, integrity, and privacy by leveraging blockchains decentralized and immutable nature. This review synthesizes current research by analyzing recent advancements in this domain, including data integrity auditing, secure key management, and cross-domain applications such as IoT and edge computing. Analysis reveals significant research gaps moving from theoretical models to practical implementations. Specifically, three core challenges are identified: the disconnect between conceptual architectures and costly, complex real-world deployments; persistent performance bottlenecks, such as “gas exceptions” and asynchronous blockchain limitations; and the need for interoperable, scalable, and post-quantum secure solutions. This review provides a roadmap for future research, emphasizing the development of practical frameworks and specialized architectures to bridge the gap between academic theory and industry adoption.

Keywords: Blockchain · Cloud Computing · Data Integrity · Scalability · Interoperability · Post-Quantum Security

Artificial Intelligence in Bone Cancer Diagnosis: A Comprehensive Review of Methods and Emerging Trends

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Abstract: Bone cancer is a critical health concern characterized by high mortality and complex treatment challenges, often due to late diagnosis. Early and accurate detection is essential for improving patient outcomes, but traditional diagnostic methods such as X-rays, MRI, and CT scans depend heavily on expert interpretation and are often time-consuming and variable. This paper is use to provides a comprehensive review of recent advancements in artificial intelligence (AI) technologies for the identification and classification of bone cancer, highlighting their potential to address these challenges. AI, with its capacity for analyzing complex medical imaging data, offers significant potential to enhance diagnostic accuracy and speed. The review investigates a capability of recent techniques, including neural networks, machine learning, and deep learning and assesses their effectiveness in distinguishing between infected bone and healthy bone tissues. It highlights the advantages of these AI systems in improving efficiency and accuracy, as well as their potential to standardize diagnostic practices.

Keywords: Bone cancer, Diagnostic, Machine learning, Deep learning, Neural networks, Medical imaging, Diagnostic accuracy, Clinical applications, Model interpretability.

Dynamic Model for Vibration Studies of Deep Groove Ball Bearings Considering Single and Multiple Defects in Races of ball bearing 6202-2Z

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Abstract: A dynamic vibration model for deep groove ball bearing 6202-2Z, focusing on the influence of single and multiple defects in the inner and outer races. Rolling element bearings, widely used in rotating machinery, are highly susceptible to localized surface defects that lead to abnormal vibration signatures and premature failures. To understand these fault dynamics, a mathematical model based on the principles of Hertzian contact theory, nonlinear stiffness variation, and time-varying displacement excitation is developed. The model simulates the interaction between rolling elements and defective raceways, capturing the excitation forces generated by surface discontinuities. MATLAB is used as the computational platform to implement the equations of motion using numerical integration methods, enabling detailed time and frequency domain analyses. The simulated vibration responses are further studied for different defect sizes and positions to establish defect-related characteristic frequencies. Comparative results show clear distinctions between defect-free, single-defect, and multiple-defect cases, validating the model's capability in fault identification. This dynamic defect modeling approach provides a useful framework for predictive maintenance, condition monitoring, and early fault detection methodology in industrial applications.

Keywords: Deep groove ball bearing, 6202-2Z, dynamic model, vibration analysis, MATLAB simulation, race defects, Hertzian contact, fault diagnosis.

Analysis and Validation of Stress Concentration for Different Cutout Orientations in Plates

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Abstract: One important factor affecting the strength and functionality of structural elements under static and dynamic loading is stress concentration. Cutouts in plates, which are frequently included for weight reduction, inspection access, or functional requirements, can drastically change the stress distribution in engineering design, resulting in localized stress concentration and potential failure initiation. The degree of stress concentration and its impact on the overall structural integrity are largely determined by the orientation of these cuts. The analysis and confirmation of stress concentration in plates with various cutting orientations are thoroughly examined in this paper. Critical zones surrounding the cuts are identified and the stress distribution is simulated under various loading scenarios using Finite Element Analysis (FEA). In order to correlate and validate the numerical results, experimental validation is performed on produced specimens using strain gauge techniques. Design guidelines for reducing the impacts of stress concentration can be developed thanks to the comparative study's insights into how stress concentration parameters vary depending on cutout orientation. According to the study's findings, cutout orientation is a key factor in controlling stress concentration. The project's results offer insightful design information for maximizing cutout geometry and orientation, which enhances engineering components; fatigue performance and structural efficiency.

Keywords: Stress Concentration, Cutout Orientation, Plates, Finite Element Analysis (FEA), Experimental Validation, Strain Gauge, Stress Concentration Factor (SCF), Mechanical Design Optimization

Advancing Banana Leaf Disease Diagnosis through Machine Vision and Artificial Intelligence

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Abstract: Banana is one of the most widely cultivated fruit crops in tropical and subtropical regions, yet its production is severely threatened by leaf diseases such as Sigatoka and Panama disease. These infections reduce yield, increase management costs, and directly impact farmer livelihoods. Manual disease diagnosis remains the most common approach but is labor-intensive, error-prone, and often impractical in large-scale or resource-limited settings. Recent advances in machine vision and artificial intelligence (AI) have enabled the development of automated systems for plant disease detection. This paper surveys and analyzes existing approaches for banana leaf disease diagnosis, covering traditional image processing methods, machine learning classifiers, and state-of-the-art deep learning models. We discuss commonly used datasets, preprocessing pipelines, segmentation and feature extraction techniques, and evaluation metrics, alongside reported performance. The comparative analysis highlights that while deep learning models significantly outperform traditional methods in accuracy and robustness, challenges remain in terms of dataset limitations, computational demands, and model interpretability. Finally, we identify open research problems and outline future directions, including lightweight architectures, explainable AI, multimodal approaches, and IoT-based real-time monitoring systems. These insights aim to guide future research toward practical, scalable, and farmer-friendly diagnostic solutions.

Keywords: Banana leaf disease · machine vision · deep learning · image processing · precision agriculture
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Planning, Scheduling, and Delay Analysis of a Commercial Building Using Microsoft Project (MSP): A Case Study

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Abstract: Delays in construction are common in India, causing time and cost overruns. This paper studies planning, scheduling, and delay management in commercial buildings using Microsoft Project (MSP). Three Maharashtra buildings—G+4, G+6, and G+7—were analyzed with detailed schedules. MSP tracked progress, while Time Impact Analysis (TIA) assessed delay impacts. Main delay causes included labor shortages, vendor problems, design revisions, material procurement issues, and environmental factors. Findings highlight the value of digital tools and proactive delay analysis for improving efficiency and risk management in mid-sized construction projects.

Keywords: Delay in construction, Work Breakdown Structures, Time Impact Analysis.

An Open Hardware Approach to PCB Track Design Automation: Integrating Stepper Motors, Servo Control, and G-code Interpretation

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Abstract: This research presents an open-hardware adaptation of the AxiDraw machine, designed to write or draw on any flat surface. The system supports various writing instruments such as pens, pencils, and markers. A distinctive feature is its extended jotting head, which allows it to draw on PCBs longer than the machine's physical length. The hardware comprises a PC interface, two stepper motors for the X and Y axes, a servo motor for the Z axis, motor drivers, a power supply, and an advanced PIC18F4550 microcontroller. The software stack includes Universal Gcode Sender (UGS) and Inkscape for generating and processing Gcode instructions. The pen is mounted on the Y-axis, while the Z-axis controls the pen's up-and-down motion. The machine interprets G-code a specialized control language generated from images or PCB designs to direct motor movements and accurately render the desired drawings on paper or PCB surfaces. This system effectively automates PCB track drawing by converting design files into precise control commands for mechanical execution.

Keywords: “Automatic PCB track design”, “open hardware”, “ PIC18F4550 microcontroller”, “ stepper motors”, “ servo motor”, “G-code control”, “CNC machine”

A Review of Mechanical Engineering Innovations for Sustainable Agricultural Advancements

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Abstract:

Agriculture has long been recognized as the backbone of human civilization, evolving continuously with the adoption of new tools and technologies. In the 21st century, the principles of mechanical engineering have revolutionized traditional farming practices, making them more mechanized, precise, and resource-efficient. Modern agriculture increasingly relies on advanced innovations such as automated machinery, agricultural robotics, precision farming tools, drones, and renewable energy-based systems that not only reduce human labor but also enhance productivity and sustainability. Mechanical engineering has also enabled significant improvements in fluid mechanics-based irrigation systems, efficient material handling, and sophisticated post-harvest technologies that minimize losses and ensure better quality of produce. Case studies from India highlight the impact of low-cost mechanization for small-scale farmers, while examples from technologically advanced nations demonstrate large-scale applications of robotics, artificial intelligence, and sensor-driven precision farming. These interventions show how mechanical engineering bridges the gap between traditional practices and modern demands for higher yield, reduced environmental impact, and economic viability. Despite these advances, challenges such as high initial costs, lack of technical awareness, and the need for localized solutions remain. Looking ahead, the integration of smart technologies, renewable energy, and sustainable design in agricultural machinery will play a crucial role in meeting global food security challenges. Thus, mechanical engineering continues to shape the future of agriculture, paving the way for a more resilient, efficient, and sustainable farming ecosystem.

Keywords: agricultural robotics, precision agriculture, virtual orchards, digital agriculture, simulation software, multi-robots

Seismic Analysis of R.C. Structure with Floating Column by Analysis and Shake Table Test

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Abstract:

This study presents a comprehensive seismic analysis of Reinforced Concrete (R.C.) structures incorporating floating columns, utilizing both numerical analysis and experimental shake table testing. Floating columns, which lack direct support from the foundation and transfer loads to beams or slabs, significantly influence the dynamic response and seismic vulnerability of structures. The research involves modelling a typical multi-story R.C. frame with floating columns and performing nonlinear dynamic analysis under simulated earthquake loading to evaluate structural behaviour, displacement, and stress distribution. Complementary shake table tests are conducted on scaled physical models to validate analytical results and observe failure mechanisms under real seismic excitations. The findings highlight the critical impact of floating columns on seismic performance, revealing increased lateral displacements and stress concentrations. This study aims to enhance understanding of structural response with floating columns during earthquakes and provide insights for safer design and retrofitting strategies. The behaviour of a building during earthquake depends critically on its overall shape, size and geometry, in addition to how the earthquake forces are carried to the ground. Provision of floating columns resting at the tip of taper overhanging beams increases the insecurity of the lateral load resisting system due to vertical discontinuity.

Keywords: Seismic analysis, shake table test, earthquake loading.

Investment Preference Analysis of KOZIMASHI Bank of Secondary School Teachers of selected villages in Hatkanangale Taluka

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Abstract:

The present study is focused on understanding the investment preferences of secondary school teachers from selected villages of Hatkanangale. Teachers occupy a significant position in society as they shape the future generation, and their financial decisions not only influence their personal lives but also reflect their awareness of various investment opportunities available in the market. The main purpose of this research is to identify the types of investments preferred by teachers, the factors influencing their choices, and the strategies they adopt for ensuring long-term financial security. To achieve this objective, primary data has been collected through structured questionnaires distributed among secondary school teachers working in the selected villages. The study also attempts to examine the level of financial literacy, risk-taking ability, and the role of income, age, and family responsibilities in shaping investment behavior. Analysis of the responses provides insights into whether teachers prefer traditional and safer investment options or are willing to explore modern, market-linked avenues. The findings of this research will be valuable for financial institutions in designing teacher-friendly investment products, and will also guide teachers in making more informed and systematic investment decisions for a secure future.

Keywords: investment preference, investment scheme, investment avraness.

Key Components of Training and Development for Employee Growth and Contribution at Sahyadri Motors Pvt. Ltd., Sangli.

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Abstract:

Training and Development (T&D) has emerged as a vital human resource function that directly influences both the growth of employees and their contribution to organizational success. In today's competitive automotive sector, where rapid technological changes and evolving customer expectations are the norm, the effectiveness of T&D initiatives determines how well employees adapt, perform, and deliver results. This study focuses on Sahyadri Motors Pvt. Ltd., Sangli, with the aim of examining the key components of T&D such as training needs assessment, clarity of learning objectives, relevance of content, delivery methods, on-the-job coaching, and systematic evaluation. The research adopts a descriptive design and utilizes a structured questionnaire to collect primary data from employees across sales, service, spares, administration, and finance departments. Statistical tools will be applied to test the relationship between T&D components and outcomes like skill enhancement, productivity, service quality, and overall contribution. The expected findings are that well-structured T&D systems not only strengthen employees' technical and behavioral competencies but also create a culture of continuous improvement and accountability. The study is significant because it provides insights into how training interventions can be aligned with organizational goals to maximize both individual career growth and business performance.

Keywords: Training and development, Employee growth, Employee contribution,

A Review of Bearing Failure Modes

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Abstract: Bearings are vital components in rotating machinery, ensuring smooth motion and efficient power transmission by reducing friction between moving parts. Despite their robust design, bearing failures remain one of the primary causes of mechanical breakdowns in industrial systems. This paper presents an extensive review of common bearing failure modes, their underlying mechanisms, causative factors, and preventive measures. The most frequently observed failures include rolling contact fatigue, wear, corrosion, electrical erosion, and plastic deformation. Contributing factors such as improper lubrication, contamination, misalignment, excessive loading, and poor installation are identified as critical influences on bearing life. Diagnostic approaches including vibration analysis, acoustic emission monitoring, oil analysis, and thermography are discussed for early fault detection. The paper further highlights recent advancements in condition monitoring using artificial intelligence and data driven prognostics for predictive maintenance. Effective prevention is found to rely heavily on correct bearing selection, proper lubrication management, contamination control, and precise installation. The review concludes that integrating advanced sensing technologies with physics-based models can significantly enhance fault diagnosis accuracy and improve reliability in modern rotating systems. The findings serve as a valuable reference for researchers and maintenance engineers seeking to improve bearing performance and extend operational life.

Key words: Deep groove ball Bearing, static analysis, Dynamic analysis etc.

Intelligent Perception: A Deep Learning Approach to Fruit Detection and Ripeness Classification

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Abstract: The imperative to guarantee fruit quality and freshness presents a significant challenge within contemporary agricultural and post-harvest supply chain operations. Prevailing manual techniques for fruit detection and ripeness evaluation are characterized by high labour costs, subjectivity, and proneness to error, which contribute directly to post-harvest inefficiencies and losses. This paper proposes a robust, deep learning-based framework to automate these processes with enhanced precision. Our methodology integrates a Convolutional Neural Network (CNN) for ripeness stage classification with a YOLOv5 model for efficient object detection. To ensure model generalization, a stratified and augmented dataset encompassing diverse fruit types and ripeness levels was curated. System performance, rigorously validated using standard metrics (accuracy, precision, recall, F1-score, and mAP), confirms its potential as a scalable solution for intelligent agricultural monitoring and quality assurance.

Keywords: Fruit quality, Freshness, Agricultural supply chain, Post-harvest operations, Post-harvest losses, CNN, YOLOv5, Quality assurance.

Integrating Renewable Energy and Diesel Power: A Hybrid Approach for Efficient EV Charging Stations

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Abstract:

The study addresses the need for sustainable and reliable charging infrastructure for electric vehicles by proposing a hybrid system combining solar photovoltaic energy, battery storage, and a diesel generator governed by a fuzzy logic control strategy. Simulation results demonstrate that this configuration achieves about 65% renewable energy penetration, cuts diesel consumption by roughly 75%, and lowers carbon emissions by over 60% compared to diesel only setups. The diesel generator runs fewer than four hours daily at an optimal 80–85% load, improving fuel efficiency and reducing costs. Power quality remains stable, with voltage and current harmonic distortions under 5% and 2%. Economically, the system reaches payback in about 3.5 years and has an estimated levelized cost of ₹6.8 per kilowatt-hour, confirming its feasibility. Overall, the research underscores the hybrid system's potential to support resilient, low-emission EV charging, especially in regions with limited grid reliability.

Keywords: hybrid energy system, electric vehicle charging, solar photovoltaic, diesel generator, battery storage.

FPGA Based Multicore Design to Enhance Power Efficiency

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Abstract:

In the list of battery-operated edge devices that are everywhere and have energy-efficient computing as their main need are wearables, mobile phones, active implanted medical devices, unmanned aerial vehicles, autonomous and electric vehicles, and hardware modules used in smart IoT infrastructure and cyber-physical systems. Leakage current in logic and memory circuits is one of the main causes of energy efficiency loss. Furthermore, the rise of on device intelligence necessitates more calculations, more storage per device, and more operations per watt. This work has assessed a dynamic power management method for multi-core systems based on FPGA for improved performance. Because it enables power savings when any of the cores are not in use, power management of multi-core CPUs is incredibly possible. The workloads' phase behavior should be considered when deciding the granularity on which the cores can be slowed or turned off. This idea is thoroughly evaluated and proposed for validation.

Keywords: FPGA, DVFS, IOT, Multicore, Power Efficiency.

SignSpeak: Real-Time Gesture to Text and Audio For Speech Impaired

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Abstract: SignSpeak is a unique, real-time software that helps bridge communication gaps for those who have speech impairments by decoding hand gestures into text and voice. The system employs state-of-the-art technologies such as OpenCV and MediaPipe to precisely identify an extensive variety of hand gestures. When an identified gesture is recognized, it is instantly translated to its corresponding textual form. To make communication highly accessible, Text-to-Speech (TTS) technology is next used to voice over the identified text. This constant, live translation enables immediate communication, which greatly helps individuals who struggle with traditional verbal communication, like speech-impaired or language disordered individuals. By translating non-verbal signals into verbal words, SignSpeak readily dissolves typical communication barriers. In addition to assistive technology for the differently-abled, the system has potential in many areas of everyday life, ranging from interactive presentations to hands-free communication. The incorporation of text and speech ensures accessibility and inclusivity, enabling communication to be more dynamic and sensitive to the needs of multiple users. The strength and responsiveness of SignSpeak represent an important step toward building more inclusive communication settings.

Keywords: Artificial Neural Network, Sign Language Recognition, Region of Interest, Communication Accessibility, Virtual Talking, Gesture Recognition, Recurrent Neural Network, Assistive Technology.

Study Efficient Management of Equipment Manpower in Construction Projects

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Abstract: Successful execution of construction projects relies heavily on systematic planning and scheduling, as these factors directly impact timelines, costs, and the effective use of resources. Conventional scheduling techniques often fall short in addressing the complexities of modern projects, resulting in delays, cost escalations, and inefficiencies. This research explores the role of Microsoft Project (MSP) as a project management tool to improve efficiency in construction practices. A representative case project was analyzed by applying MSP features such as Work Breakdown Structure (WBS) preparation, Gantt chart scheduling, resource assignment, and Earned Value Management (EVM) for performance monitoring. The findings show that MSP enhances schedule transparency, ensures precise tracking of progress, and facilitates balanced utilization of manpower and materials. Reports generated through MSP, including cash flow, earned value, and resource summaries, revealed that although the project lagged behind schedule by nearly 19%, cost performance was effectively maintained with a Cost Performance Index (CPI) near unity. Furthermore, comparative assessment indicated that MSP reduced the overall project duration by 166 days (about 20%) and lowered project costs by nearly 38 million (roughly 23%) compared to traditional approaches. The study demonstrates that MSP not only strengthens planning and monitoring but also contributes to timely decision-making, financial efficiency, and improved project outcomes in the construction sector.

Keywords: Microsoft Project, Construction Scheduling, Earned Value Management, Resource Optimization, Cost Efficiency

Construction Equipment Management: Understanding On-Site Influencing Factors

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Abstract:

Construction equipment plays a critical role in modern projects, where strict deadlines, quality standards, and cost efficiency are essential. Equipment-related expenses can account for 10–30% of the total project cost, highlighting the need for effective equipment management. This study investigates the impact of equipment performance on construction sites through a combination of case study analysis and a structured questionnaire survey. Using the Relative Importance Index (RII) method Data analysis shows that many sites rely on reactive maintenance, leading to frequent breakdowns, delays, and financial losses. The study emphasizes the need for a strategic maintenance approach—particularly preventive maintenance—to reduce failures, extend equipment life, and improve reliability. Incorporating predictive and proactive maintenance further enhances performance by identifying early signs of malfunction. Overall, efficient equipment management is vital to ensuring timely and cost-effective project completion

Key Words: equipment management Preventive maintenance, Relative Importance Index (RII)

Feasibility management and maintenance in highway construction zone

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Abstract: This study presents a comprehensive approach to evaluate and predict life-cycle costs (LCC) of highway infrastructure using both analytical and computational methods. Initially, the research follows a systematic workflow, including topic study, literature review, problem definition, and case study, LCCA, and results interpretation. A MATLAB-based predictive framework employing a feed-forward backpropagation neural network (TRAINLM) with one hidden layer (≈ 10 neurons, TANSIG) was developed. Historical and financial factors (unit rates, inflation, and discount rate) were used to predict annual costs and present value per maintenance event. Data were divided into training (70%), validation (15%), and testing (15%) sets, minimizing mean squared error and ensuring model robustness via K-fold cross-validation, early stopping, and z-score normalization. Scenario analyses, including preventive vs. corrective schedules, Monte Carlo simulations, and sensitivity analysis (± 10 20% shocks), quantified cost drivers and uncertainty, generating cumulative LCC curves for rigid and flexible pavements.

Keywords: Feasibility Management, Highway Construction Maintenance, Construction Zone, Infrastructure Feasibility.

Recent Developments in Cobalt Oxide Electrode Materials for Enhanced Supercapacitor Performance

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Abstract: Supercapacitors, also referred to as electrochemical capacitors, are gaining prominence as crucial energy storage solutions that bridge the gap between traditional dielectric capacitors and batteries. It may use as a potential device for the purpose of energy storage. It has fast charging like conventional capacitors and high energy density like battery which attracts the researcher to study on it. Among various electrode materials explored, cobalt oxide (Co₃O₄) stands out due to its significant redox properties, impressive theoretical capacitance, and adaptable structural characteristics. However, challenges such as low electrical conductivity and susceptibility to structural deterioration limit its practical use. This review comprehensively examines recent advancements in cobalt oxide-based electrodes for supercapacitors. It covers the basic principles of supercapacitors, the structural and electrochemical characteristics of cobalt oxide, an extensive overview of synthesis methods, and widely utilized characterization techniques. Furthermore, it highlights developments in composite and hybrid systems incorporating carbon materials, polymers, and other transition-metal oxides. The discussion also addresses issues related to conductivity, mechanical stability, cost-effectiveness, and sustainability while offering insights into future research directions such as doping strategies, heterostructuring approaches, and environmentally friendly synthesis methods. This thorough examination aims to inform ongoing investigations into cobalt oxide electrodes for next-generation high-performance supercapacitors.

Keywords: supercapacitor, cobalt oxide, supercapacitor, thin film.

Groundwater Quality Assessment for Domestic and Agricultural Purpose in Upper Part of River Vedganga basin using GIS Maharashtra, India

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Abstract:

The quality of water has a major effect on both human health and the survival of animals and plants. The amount of precipitation in an area, weathering, soil erosion, and human activities such as agriculture, industry, and urbanisation, along with the use of water resources, all have an impact on the quality of groundwater. The paper investigates groundwater quality in the Upper Part of River Vedganga basin districts of Kolhapur, Maharashtra, for irrigation and drinking purposes. Twenty-two water samples from groundwater sources (Open Well-14 and Bore Well-8) were collected, and practically all significant physicochemical properties were investigated. According to the physicochemical analysis results, the majority of the samples fell within the permitted range of Indian standard. According to the results, around 35% of the samples have conductivity levels that fall within the 'good to permissible' range. With the exception of a limited number that exhibit signs of degradation in the research region, the bulk of groundwater samples are safe to drink, according to the analytical data.

Keywords: physicochemical parameter, Urbanisation, Vedganga basin.

Optimal Inventory Management and Pricing Strategies for Perishable Products: A Comprehensive Review

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Abstract: This research paper provides a comprehensive review of optimal inventory management and pricing strategies for perishable products. By analyzing and synthesizing findings from several key studies in the field, we explore the complexities of managing perishable inventory and the various approaches to optimizing pricing and ordering decisions. Effective inventory management is critical for maintaining optimal stock levels, reducing costs, and meeting customer demands efficiently. It involves systematic planning, demand forecasting, and real-time tracking to minimize stockouts and excess inventory. The paper examines traditional lot-sizing models, joint pricing and ordering policies and the impact of demand learning on decision-making processes. In addition, we evaluate the role of dynamic pricing strategies and their ability to balance profitability with the risk of product obsolescence. Our review highlights the importance of considering product perishability in inventory management and pricing decisions, and discusses the potential for future research in this critical area of operations management. We also identify gaps in current methodologies, particularly in integrating sustainability goals and waste reduction initiatives into operational frameworks. The results offer valuable direction for practitioners directing to augment effectiveness while reducing waste. Overall, the paper underscores the significance of aligning inventory and pricing decisions for perishable products.

Keywords: Perishable Products, Inventory Management, Pricing Strategies

Agri-Tech Innovation in India: A Review of Opportunities, Challenges, and Future Pathways

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Abstract:

The rapid rise of agri-tech entrepreneurship is transforming India's agriculture by tackling persistent challenges such as low productivity, fragmented landholdings, market inefficiencies, and limited financial access. This study examines the opportunities and challenges within India's agri-tech ecosystem from 2020 to 2025 through a review of over 150 sources, including academic papers, industry reports, government publications, and startup databases like Tracxn, Crunchbase, and AgFunder. Findings show strong potential for boosting productivity, expanding digital inclusion, promoting sustainable farming, and generating rural employment. Key technologies—artificial intelligence (AI), Internet of Things (IoT), blockchain, and precision farming—are enhancing efficiency and market transparency. Policy initiatives like Startup India, RKVY-RAFTAAR, and Atmanirbhar Bharat, alongside incubation hubs in Maharashtra, Karnataka, and Uttar Pradesh, have supported the growth of over 1,000 agri-tech startups. However, barriers remain, including low digital literacy, risk aversion among smallholder farmers, funding gaps during scaling, infrastructure deficits, and regulatory complexity. Lessons from Indonesia and African countries highlight the need for localized, collaborative strategies to address these issues. The study emphasizes multi-stakeholder efforts combining policy support, financial innovation, digital capacity building, and sustainability to unlock agri-tech's full potential. Future research should focus on long-term impacts, adoption patterns, and gender perspectives for a comprehensive understanding of agri-tech's socio-economic role.

Keywords: Agri-tech entrepreneurship, digital agriculture, technology adoption, sustainable farming, Indian agriculture, rural development, innovation ecosystem.

Enhancing Productivity in Retail Pharmacy Through the Application of Quality Tools – A Case Study

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Abstract:

The objective of this study is to explore the application of various quality tools in retail pharmaceutical stores to enhance productivity. This research provides a concise introduction to the enhancement of productivity within retail pharmaceutical environments. To achieve significant customer satisfaction in the current highly competitive retail pharmaceutical market, it is essential to improve productivity. This research examines different quality tools employed to minimize excess inventory costs, reduce customer waiting times, decrease order rejections, address drug retrieval issues, and mitigate the expiration of medicines in retail pharmaceutical stores. Additionally, it facilitates the organization of medicines, expedites the search for medications, simplifies the management of multiple customers, and enhances documentation, record-keeping, and cleanliness within retail pharmaceutical establishments. All these activities contribute to the reduction of various costs in the retail pharmaceutical process and assist in boosting the productivity of retail pharmaceutical stores. The results of this study demonstrate how well quality management strategies work to maximize operations in retail pharmacies. In addition to increasing efficiency, the strategy promotes employee involvement and a continuous improvement culture. This case study shows how retail pharmacies can use a structured quality tool deployment as a useful framework to boost operational effectiveness, boost competitiveness, and eventually improve patient care results.

Keywords: Lean, 5S, Pareto Chart, Visual Tools, Kaizen retail pharma store

Robust Video Surveillance: A Comparative Analysis of Spatio-Temporal Models for Crowded Scene Anomaly Detection

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Abstract:

This paper presents an in-depth comparative analysis of state-of-the-art spatio-temporal models for anomaly detection in crowded video surveillance scenarios. The review investigates a spectrum of methodologies, including approaches based on optical flow, convolutional neural networks (CNNs), autoencoders, generative adversarial networks (GANs), attention mechanisms, graph neural networks (GNNs), and hybrid frameworks. Emphasis is placed on how each technique leverages spatial and temporal cues to identify abnormal activities, especially under challenging real-world conditions such as variable lighting, scene occlusion, and high-density crowds. Key strengths and limitations are highlighted, such as the sensitivity of optical flow models to noise, the computational complexity of deep ensemble architectures, and the real-time constraints of attention-based algorithms. This work also underscores the importance of robust generalization, adaptability to unseen environments, and integrating multi-modal information for improving anomaly detection accuracy. Performance metrics and benchmark datasets including UCSD Ped1/Ped2, CUHK Avenue, and ShanghaiTech—are covered to provide objective comparisons across methods. By synthesizing recent advances and emerging trends, this review offers practical insight for the deployment of effective anomaly detection systems in large-scale dynamic surveillance environments, identifying open challenges, and proposing future directions for research in crowd video analysis.

Keywords: Video Anomaly Detection Spatio-Temporal Modeling Crowd Surveillance Deep Learning Optical Flow · Convolutional Neural Networks (CNNs) Autoencoders Generative Adversarial Networks (GANs) · Attention Mechanisms · Graph Neural Networks (GNNs) · Hybrid Architecture · Real-Time Detection · UCSD Pedestrian Dataset · Evaluation Metrics (AUC, EER, ROC).

ESP32-Based Bluetooth Mesh Sensor Network for Data Collection and Command Control

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Abstract:

Wireless Sensor Networks (WSNs) are increasingly integral to smart environments, offering distributed sensing, communication, and control capabilities. This paper presents the design and implementation of a Bluetooth Mesh Sensor Network based on ESP32 microcontrollers for real-time environmental data acquisition and command-and-control operations. The proposed system leverages the Bluetooth Mesh protocol to overcome the range limitations of traditional Bluetooth, enabling multi-hop communication and improved network scalability. The network comprises four functional node types: sensor nodes, relay nodes, actuator nodes, and a gateway node. Sensor nodes are equipped with temperature, humidity, motion, and gas sensors, while relay nodes extend network coverage. The gateway node connects the mesh to cloud platforms such as ThingsBoard, Firebase, or AWS IoT via MQTT/HTTP. Actuator nodes execute commands received from the central server. The system uses a publish-subscribe model for mesh communication and supports bi-directional data flow. Experimental evaluation demonstrates low-latency communication (50 ms for one hop, 230 ms for five hops), a packet delivery ratio above 95% for up to 50 nodes, and significant energy savings through deep sleep modes. The system is applicable in smart homes, industrial automation, precision agriculture, and urban infrastructure monitoring. Future work includes integrating AI-based analytics, energy harvesting mechanisms, and hybrid 5G/LoRaWAN connectivity to enhance system intelligence and scalability.

Keywords: ESP32, Bluetooth Mesh, IoT, Sensor Network, Wireless Communication

Impact of Poor Workmanship on Construction Industry High Rise Buildings

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Abstract: Poor workmanship is a common challenge in the construction industry, negatively affecting the quality, safety, and cost-effectiveness of building projects. This paper presents an in-depth analysis of the primary causes and impacts of poor workmanship on various factors of high-rise construction. The study is based on a combination of literature review, field data collection through case study evaluations. Key risk factors were identified, and feedback from site personnel was used to calculate the Priority Score of these risk factors along with their risk reduction percentages. The findings highlight the significant influence of poor workmanship on construction performance and emphasize the need to improve workmanship standards to enhance the overall quality of construction projects.

Key Words: High rise building, Poor Workmanship, Risk Factors.

An overview of Context Aware Sentiment Classification using Deep Learning Techniques

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Abstract:

Image-based sentiment classification has emerged as a crucial research domain in the intersection of computer vision, natural language processing, and affective computing. Unlike traditional sentiment analysis that primarily focuses on text, image-based approaches capture emotional cues through visual context, offering deeper insights into human affective states. This paper presents an overview of context-aware sentiment classification techniques that employ deep learning architectures to enhance accuracy and robustness. By leveraging convolutional neural networks (CNNs), recurrent neural networks (RNNs), attention mechanisms, and multimodal fusion frameworks, modern approaches are able to capture both local and global features of images, as well as contextual dependencies such as background, surrounding objects, and facial expressions. We discuss how contextual features play a significant role in understanding nuanced sentiments that cannot be interpreted through isolated visual data. Furthermore, this survey emphasizes the importance of integrating semantic knowledge, scene understanding, and domain-specific priors for improved sentiment prediction. Several benchmark datasets and evaluation metrics are reviewed, highlighting performance comparisons of existing models. Despite recent advancements, challenges such as noisy data, cultural differences in sentiment perception, and limited availability of annotated datasets persist. Finally, the paper identifies research gaps and outlines future directions including lightweight deep learning architectures, cross-domain adaptation, and explainable AI for transparent decision-making. This comprehensive overview serves as a reference for researchers aiming to design more effective context aware sentiment analysis frameworks for real-world applications in marketing, healthcare, human-computer interaction, and multimedia retrieval.

Keywords: Image sentiment classification, Context-aware analysis, Deep learning techniques, Feature extraction, Emotion recognition, Machine learning classifiers.

Design, Analysis and Manufacturing of Pressure Testing Fixture to Reduce the Leakage in Tee Bend Casting Component

Mr. Sudhirkumar Pandurang Godashe and Prof. Mahesh Kumar Sutar

Abstract:

This project focuses on the design, analysis, and manufacturing of a leak test fixture for Fluid Metal Company, located in Kolhapur MIDC. The company supplies Tee bends used in the pneumatic compressor piping of Cummins generators. The developed fixture enables precise pressure testing under simulated working conditions, ensuring the components meet required strength, integrity, and safety standards. By identifying defects and weaknesses during production, the fixture enhances quality control, minimizes downtime, and prevents costly repairs. This proactive testing approach ensures reliable performance, compliance with industry norms, and improved operational safety for pneumatic compressor systems in diverse industrial applications.

A Review On Auto-Generated Carbon Credit Software System

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Abstract:

One of the biggest problems the world is currently experiencing is climate change, and a sustainable future depends on lowering carbon emissions. Currently, individual's efforts are frequently disregarded by carbon credit systems, which primarily target huge organizations and corporations. The foundation for auto-generated carbon credits for individual user is presented in this paper, enabling anyone to participate in carbon reduction efforts and receive automated rewards. The suggested system gathers data in real time using mobile apps, smart sensors, and Internet of Things devices. Regarding a user's transportation, energy use, and renewable energy habits. The system uses this information to calculate an individual's carbon footprint and the amount of carbon saved by eco friendly activities. While blockchain technology securely stores and verifies carbon credit transactions, machine learning algorithms aid in ensuring correct computations. As a result, the procedure is reliable and transparent. The framework encourages people to live in an environmentally friendly way by rewarding actions like saving electricity using electric vehicles or recycling. It also supports government as well as environmental regulations for long-term growth. The methodologies, data flow, and working model for the automatic creation and validation of carbon credits are described in this study.

Keywords: Carbon credit, Automation, Blockchain, IoT, Sustainable Development

Object Tracking using Template Matching Algorithm

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Abstract: Object tracking plays a vital role in the domain of computer vision. With advancements in computational power, the availability of high-speed and cost-effective video cameras, and the increasing demand for automated video analysis, there has been significant interest in developing efficient algorithms for detecting, tracking, and interpreting the motion of objects in dynamic scenes. Object tracking algorithms have gained significant attention. Video analysis generally involves three major stages: identifying moving objects of interest, tracking them across consecutive frames, and interpreting their trajectories to understand their behaviour. This paper presents a cost-effective automated single-object tracking system based on the concept of dynamic template matching. A standard laptop webcam is utilized to capture video frames and track the selected object. Once the object is detected, a template-matching algorithm is applied to maintain continuous tracking. The proposed system offers a simple yet efficient approach suitable for real-time surveillance applications.

Keywords: Template, Tracking, Detection, Kernel tracking, Area-based matching, Computer vision, Frame, Correlation Coefficient, Object Representation.

Optimized Bidirectional DC to DC Converter for Solar PV Application

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Abstract:

This paper presents the design and optimization of a bidirectional DC–DC converter for solar photovoltaic (PV) applications. The converter facilitates bidirectional power flow between the PV array and the battery storage unit, enabling both charging and discharging operations. During high solar irradiance, the converter functions in buck mode to charge the battery, and during low irradiance or night-time conditions, it operates in boost mode to discharge the stored energy to the load. To maintain voltage stability and efficient power transfer, a Proportional–Integral (PI) control strategy and Maximum Power Point Tracking (MPPT) algorithm are employed. Simulation and experimental validation using MATLAB/Simulink demonstrate high conversion efficiency, fast dynamic response, and excellent voltage regulation.

Keywords: Bidirectional DC–DC Converter, Solar PV, Battery Charging, MPPT, Buck–Boost Converter, PI Control, Renewable Energy.

A Review Paper on Vibration Analysis of Shaft

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Abstract: This paper reviews research on the vibration behavior and mathematical modeling of misaligned shafts, with a focus on evaluating various methodologies proposed by different researchers. The study aims to understand the impact of shaft misalignment on vibration characteristics and emphasize the importance of accurate modeling. Shafts and motors are critical components in industrial machinery, yet misalignment remains a major contributor to equipment failures and operational inefficiencies. Perfect alignment between driving and driven shafts is difficult to maintain due to factors such as foundation settlement, thermal effects, and continuous machine operation. While misalignment may have minimal impact on motor efficiency, it significantly affects smooth power transmission, vibration levels, and the lifespan of machinery. Shaft misalignment occurs when the axes of the driving and driven shafts do not coincide, causing excessive vibrations, elevated noise, increased temperatures in couplings and bearings, and accelerated wear of components. Researchers have studied this phenomenon using both analytical and experimental approaches. Misalignment is generally classified as either parallel (offset) or angular, although real-world machinery often exhibits a combination of both, resulting in complex vibration patterns.

Keywords: Rotor Shaft, Misalignment, Vibration Analysis.

Design Evolution of a Dual-Band Microstrip Patch Antenna Using DGS and U-Slots for 5G NR Bands

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Abstract: This paper presents a compact dual-band Microstrip Patch Antenna (MPA) employing a defected ground structure (DGS) and dual inverted U-shaped slots to enhance the impedance bandwidth for sub-6 GHz 5G applications. The inset feed antenna is built on an FR4 substrate and optimized using a Genetic Algorithm (GA) in ANSYS HFSS. A four-step design evolution, transitioning from a conventional patch to a DGS with single and dual inverted U-slots, demonstrates significant bandwidth enhancement. The optimized antenna achieves dual-band operation with an absolute impedance bandwidth of 590 MHz (fractional bandwidth of 16.35%) at 3.76 GHz and 180 MHz at 4.66 GHz, while maintaining a VSWR of 1.011, a peak gain of 3.17 dB, a directivity of 4.74 dB, and a radiation efficiency of 64.54%. The proposed antenna demonstrates nearly a fivefold enhancement in impedance bandwidth compared to a conventional patch, while maintaining a compact footprint of $30.9 \times 28.8 \text{ mm}^2$ and stable radiation for sub-6 GHz 5G NR (n77/n78/n79), Wi-Fi, and IoT networks.

Keywords: Microstrip Patch Antenna (MPA), Defected Ground Structure (DGS), U-slot, dual-band antenna, bandwidth enhancement, HFSS, sub-6 GHz 5G NR

Comprehensive Survey on Blockchain and IoT Based EHR Analysis using IOT & Deep Learning

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Abstract: The role of healthcare technology within the early detection and prediction of heart diseases has evolved due to the amalgamation of Blockchain, Internet of Things (IoT), and Deep Learning (DL) technologies. This survey aims to highlight the integration of these technologies toward devising an efficient, secure, intelligent, real-time monitoring system for heart diseases. Remote monitoring of cardiovascular health is now possible through continuous collection of ECG, heart rate, blood pressure, and oxygen saturation data through IoT-enabled wearable sensors. These health data streams are analysed by deep learning models—Convolutional Neural Networks (CNNs), LSTM networks, or hybrid models—deployed on edge or cloud computing platforms to identify and predict with high accuracy the onset of heart diseases. Blockchain technology addresses security, privacy, and integrity issues by providing tamper-proof decentralized storage, transparent access control, and controlled medical data sharing which ensures privacy. Automated smart contracts aid in the facilitation of secure data transmission and automate access permissions between patients, doctors, and healthcare institutions. This survey synthesizes more than 95 peer-reviewed research and experimental publications, divides critical findings along thematical, algorithmic, and evaluation standards including accuracy, sensitivity, and latency. The results support that blockchain technology preserves data immutability and accountability, while deep learning sharpens the accuracy of diagnoses. Also discussed are the challenges of energy efficiency in IoT devices, scaling the blockchain, data heterogeneity and model interpretability, as well as proposed future avenues of inquiry such as federated learning, quantum blockchain, and cross-platform interoperability. In conclusion, this research emphasizes the integrated BIoT-DL framework that enables predictive, personalized, and preventive cardiovascular care, thus advancing the development of sophisticated smart healthcare systems. The review is helpful for the scholars, developers and policymakers intended the deployment of intelligent, secure, and dependable systems for heart disease detection and prognosis.

Keywords: Blockchain, supply chain management, hash generation, traceability, mining, smart contract

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Comparative behavior of high-rise building provided with RCC, PSC and steel virtual outriggers

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Abstract:

In present years, high-rise buildings (HRB) are considered to be the symbols of economic power and leadership throughout the world. As HRB are tall structures, they get subjected to wind and seismic pressures resulting into displacements and reduction of stiffness. To control such effects, many lateral load resisting systems viz., shear walls, belt-trusses, outriggers, etc. are employed, however, outrigger system has been found to be the most effective. In this paper, comparative behaviour of HRB consisting different heights (viz., 80m, 85m, 90m, and 100m) is analyzed using 'ETABS-2018' considering without and with RCC, Prestressed concrete (PSC) and Steel virtual outriggers by varying their positions along building height (vi., 'H', 'H & ¼ H', 'H ½ H'). Results for maximum storey displacement, maximum storey drift and base shear of HRB are obtained for seismic zones IV and V with medium soil. Results show that displacement of HRB with steel outriggers for seismic zone IV and all heights get increased by 12.08% and 9.94% respectively as compared to HRB with RCC and PSC outriggers, while drift gets increased by 9.06% and 6.03% respectively over the HRB with RCC and PSC outriggers. The displacement and drift for HRB with steel outriggers decreased by an average value of 46.66% when compared with HRB without outriggers. No significant change in the base shear is observed. The study concludes that HRB with steel outriggers perform better when compared with HRB consisting RCC and PSC outriggers for all the heights and seismic zones IV and V.

Keywords: High-rise building, RCC, Steel and PSC virtual outrigger, seismic zones, structural responses.

Degree Engineering Teacher's Investment Analysis: Institutes under Jurisdiction of Shivaji University, Kolhapur & Dr. Babasaheb Ambedkar Technological University, Lonere (Non-Autonomous institutes of Kolhapur City)

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Abstract:

In the market various investment options are available. Incomes of the engineering teacher's are increasing due to increase in the pay scale of as per the government rules. Today Indian economy is growing very rapidly hence every salaried person investing their money various investment avenues. In India various types of investment avenues are available. Income source of Indian people are more such as agriculture income, small enterprises small shops, consultancy etc. Through the various sources of income people are having good amount of funds hence they are investing their money in various types of avenues. Every person wants to make high returns of on their investment. The market is very sharp at the level returns because high investment raise high risk as well as high returns. In Kolhapur city various types of business are running from traditional top modern. Not only salaried person but also entrepreneur wants to make high returns on their investment. Marketable non marketable investment avenues are available for degree engineering teacher's of non autonomous institutes of Kolhapur city comes under Shivaji University Kolhapur city & Dr. Babasaheb Ambedkar Technological University, Lonere.

Keywords: Engineering teachers' investments, investment avenues, return on investment.

Investigation and analysis of layer thickness and infill pattern on tensile strength of PLA material in 3D printing

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Abstract:

Additive manufacturing (AM) enables more customisation and design freedom, reduced waste, faster prototyping, and the development of difficult profile forms. The mechanical strength of the finished product is directly impacted by the printing parameters used in 3D printing. This study investigated the effects of different infill configurations (Grid, Rectilinear, Honeycomb), infill density (15%), and layer thicknesses (0.1 mm, 0.2 mm) and material (PLA) in that order. Experimental studies show that the honeycomb infill pattern has a higher tensile strength than the grid and rectilinear infill patterns at all infill patterns and layer thicknesses. When the layer thickness reaches 0.1 mm, the honeycomb infill geometry's tensile strength increases.

Keywords: 3D printing, infill pattern, infill density, layer thickness, tensile strength

Cloud Computing for Resource Optimization and Security in Rural Cooperative Credit Societies

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Abstract:

Rural cooperative credit societies are essential for guaranteeing financial inclusion, but they frequently use antiquated, paper-based management techniques that compromise security and efficiency. The potential of cloud computing for data security and resource optimization in Primary Agricultural Credit Societies (PKPS) in the Maharashtra–Karnataka border region is examined in this study. A sample of 200 respondents from 20 branches was selected from the target population, which consists of about 300 PKPS out-lets. Convenience sampling was used to target employees and committee members, while purposeful sampling was used to involve managers and committee members with IT-related knowledge. A 5-point Likert scale was used in a structured questionnaire to gather data on concepts like adoption willingness, security concerns, optimization potential, and cloud awareness. MS Excel and SPSS were used for the analysis, and graphical tools were used to provide descriptive insights. The findings show that while cloud solutions are moderately well-known, their ability to lower IT expenses through shared infrastructure and improve data security through encryption and two-factor authentication is strongly acknowledged. Lack of technical know-how and worries about cyberthreats, however, continue to be major obstacles. The results demonstrate the revolutionary potential of cloud-based MIS for PKPS as a precursor to rural cooperatives' digitalization. Pro-prototype development and pilot testing will be the main focus of future work in order to assess operational viability and long-term impact.

Keywords: Cloud computing in rural finance, Resource optimization in cooperative credit, Data security in Primary Agricultural Credit Societies, Digital transformation of rural cooperatives.

Implementation of Maize Plant Leaf Disease Detection Using Convolutional Neural Networks

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Abstract:

A novel approach to identifying leaves in maize plants is presented in this research. It is based on a hybrid Convolutional Neural Network (CNN)-Support Vector Machine (SVM) model. Given the increasing global reliance on maize as a staple crop and industrial product, reliable, early detection technologies are crucial to minimize crop losses. Traditional human visual inspection-based methods are time-consuming and prone to human error, especially in high-scale or distant field conditions. The approach leverages the strength of CNNs to automatically learn hierarchical features from images of maize leaves. For improved performance, these features are then classified by SVM, renowned for its capability to handle high-dimensional data robustly and generalize when the training sets are limited. Data augmentation techniques like rotation, flipping, and zooming are applied to a portion of the well-known PlantVillage dataset to improve model generalization and prevent over fitting. Experiments demonstrate the hybrid CNN-SVM model's high accuracy, precision, recall, and F1 scores. Hence, it effectively distinguishes healthy and diseased leaves in various conditions. Executed with Python libraries such as TensorFlow, Keras, and OpenCV, the suggested approach works optimally on commodity hardware, thereby being suitable even for resource-limited applications. The findings demonstrate how cutting-edge image processing and machine learning may be combined in precision agriculture to improve crop output, identify diseases in real-time, and apply pesticides more effectively. Future research areas involve extending the model to other crops and real-time integration of IoT for field-based diagnostics, thereby significantly furthering novel sustainable agricultural practices.

Keywords: Maize Leaf, Convolutional Neural Network(CNN), Deep Learning, Plant Village Dataset, Support Vector Machine (SVM), Image Processing, Precision Agriculture, Python, Keras, TensorFlow

Structural Assessment and Strengthening of RCC Columns Using Non-Destructive Testing and Finite Element Modelling

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Abstract: The safety and durability of reinforced concrete (RCC) structures are of increasing concern, particularly for aging buildings subjected to higher service loads. This study presents a structural audit of an existing 30-year-old G+2 RCC building where the owner intended to add an additional floor. A series of non-destructive tests (NDT), including rebound hammer, ultrasonic pulse velocity (UPV), half-cell potential, and core compression testing, were conducted to assess the residual strength. Finite Element Modelling (FEM) using STAAD.Pro and ANSYS was employed to simulate the performance of weak columns retrofitted with steel plates of varying thickness (3 mm, 4 mm, and 7 mm). Results demonstrated that strengthening with steel plates significantly reduced deformation and stress concentrations, thereby increasing the load-carrying capacity of weak columns. The study highlights the synergy between NDT evaluation and FEM-based strengthening strategies, offering a reliable methodology for sustainable retrofitting of RCC structures.

Keywords: Reinforced Concrete (RCC), Non-Destructive Testing (NDT), Finite Element Modelling (FEM), Steel Plate Jacketing, Column Retrofitting, Structural Strengthening

Use cases of artificial intelligence in education, agriculture and healthcare: Advances & challenges

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Abstract: The increasing integration of Artificial Intelligence (AI) into daily life is elevating living standards. The technological revolution driven by AI across various industries is resulting in more efficient, cost-effective, and precise outcomes. Streamlined, safer, and more secure daily operations are boosting productivity in numerous sectors, including healthcare, e-commerce, agriculture, transportation and navigation, education, banking and finance, data security, supply chain management, medicine, and automotive. This document presents a systematic review of existing literature regarding the use of AI in three significant areas of human life: education, agriculture, and healthcare. It addresses the current implementation of AI within these sectors, along with its societal benefits and drawbacks. The paper also summarizes AI research, its link to technological advancements and applications, as well as the challenges faced during practical implementation in these three fields. In conclusion, we highlight the progress made in AI applications to achieve accurate results.

Keywords: Artificial intelligence, healthcare, education, agriculture, advances, challenges.

DNA-Based Data Storage System

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Abstract: The exponential growth of digital data has resulted in a critical need for new data storage technologies that offer ultra-high density, stability, and sustainability. DNA, the molecule that stores biological information, has emerged as a revolutionary medium for digital data storage due to its exceptional information density, long-term durability, and minimal maintenance requirements. This paper presents an overview and implementation approach for a DNA-based data storage system, highlighting the processes of encoding binary data into nucleotide sequences, synthesis of DNA strands, and decoding using sequencing technologies. The paper also discusses various encoding algorithms, synthesis constraints, error correction methods, and potential real-world applications. DNA as a storage medium provides storage densities of up to 215 petabytes per gram and can preserve data for thousands of years in the right circumstances. The potential of combining computer science and biotechnology to create next-generation data storage solutions is demonstrated by this suggested system.

Keywords: synthetic biology, digital encoding, biotechnology, DNA data storage, and data retrieval

Embodied Energy Assessment of Conventional and Alternative Building Materials for Sustainable Infrastructure in Western Maharashtra, India

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Abstract: The construction industry is a major energy consumer and greenhouse-gas emitter globally, particularly in India. This study presents a comprehensive embodied energy (EE) evaluation of building materials commonly used in Western Maharashtra, including conventional materials (clay bricks, cement blocks, steel, aggregates, sand) and sustainable alternatives (soil-stabilized blocks, fly ash bricks, bagasse-ash bricks). The study applies a cradle-to-gate boundary, incorporating fossil fuel consumption, electricity, human labor, and transportation energy. Enhanced by regional field data and validated against benchmarks such as the ICE database, Indian Construction Materials Database, and recent literature, the results demonstrate that alternative materials can reduce EE by up to 70%. Insights on material selection, transport optimization, and policy implications are provided. The findings reinforce the importance of integrating EE assessment into building design and policy frameworks for low-carbon, sustainable construction.

Keywords: Embodied energy, sustainable materials, cradle-to-gate, building materials, India, life cycle assessment

Prototype Development for Smart Irrigation and Crop Protection to Vegetable Farms in Agricultural Areas Adjacent to Forests

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Abstract:

Sustainable agriculture demands innovative solutions that optimize water use while ensuring crop protection, particularly in forest-adjacent vegetable farms. This paper presents a prototype for a smart irrigation and crop protection system integrated with a cloud-based web application for real-time monitoring and automation. The system employs IoT-based sensors and actuators controlled through an ESP8266 Wi-Fi module, which connects field devices to an online dashboard. Soil moisture sensors monitor hydration levels and automatically trigger irrigation through relay-driven solenoid valves, minimizing water wastage. A PIR sensor detects unauthorized movement to protect crops from animal or human intrusion, while a current-voltage sensor monitors power availability to adjust irrigation schedules during outages. An LDR sensor tracks light intensity, optimizing watering times based on environmental conditions. Real-time sensor data are visualized on a user-friendly web platform that allows scheduling and manual overrides. Experimental testing on vegetable plots confirmed efficient irrigation control, timely alerts, and reliable anomaly detection. The system significantly reduces manual intervention, enhances water management, and ensures farm security. By integrating automation, sensing, and web connectivity, the proposed model demonstrates a cost-effective, scalable, and sustainable approach for precision agriculture in forest-adjacent rural environments.

Keywords: Smart Irrigation, IoT in Agriculture, ESP8266, Solenoid Valve, Soil Moisture Sensor, PIR Sensor, Precision Farming, Forest-Adjacent Farms, Web Application.

Review Paper: Automation in Spray Pond Systems for Enhanced Cooling Efficiency in Sugar Industries

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Abstract:

Spray ponds are an essential cooling infrastructure in sugar factories, used to dissipate heat generated during juice heating, evaporation, and crystallization processes. Traditionally, these systems have been operated manually, often leading to inefficiencies such as excessive water consumption, uneven cooling, and a lack of process monitoring. The automation of spray pond systems offers a modern solution to these limitations. This review focuses on the integration of automation technologies at Hutatma Sugar Factory, Walwa, where the system utilizes PLCs, RTD sensors, capacitive level sensors, and HMI interfaces to control temperature, water levels, and pump operations in real time. Automated control ensures precise cooling performance, minimizes energy and water wastage, and enhances operational safety. Additionally, data logging and remote monitoring enable predictive maintenance and improved decision-making. The study also examines global trends in industrial water spray automation, including the use of IoT-enabled devices, SCADA systems, and AI-based control algorithms. These advancements demonstrate how automation can significantly improve efficiency, sustainability, and reliability in sugar industry cooling operations, setting a benchmark for other process industries to adopt similar intelligent control systems.

An Integrated IoT Architecture for Real-Time Anti-Poaching and Forest Monitoring Using a Multi-Sensor Network

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Abstract:

Illegal logging and forest fires pose serious threats to environmental sustainability, biodiversity and national economies, particularly through the exploitation of high-value species such as Indian Sandalwood and Teak. Conventional surveillance methods relying on manual patrols are often ineffective due to vast forest areas and delayed response times. This paper presents a cost-effective, IoT-based anti-poaching and fire detection system that enables continuous, automated forest monitoring. The proposed design integrates an Arduino Mega 2560 microcontroller with multiple sensors an ADXL335 accelerometer for vibration and tilt detection, a sound sensor for chainsaw noise identification and a DHT11 sensor for temperature monitoring. Detected anomalies activate local actuators such as a buzzer and submersible water pump for immediate on-site response, while an ESP8266 Wi-Fi module transmits real-time data and alerts to the ThingSpeak cloud platform for remote supervision. The system was rigorously tested under simulated conditions, demonstrating high accuracy, low false-positive rates and reliable wireless communication. Results confirm its capability to detect illegal logging and fire events promptly, providing both deterrence and rapid response mechanisms. This IoT-driven, scalable approach offers a practical pathway toward sustainable forest protection with potential future enhancements in energy autonomy, long-range connectivity and intelligent pattern recognition using machine learning.

Keywords: Internet of Things (IoT), Wireless Sensor Network (WSN), Anti-Poaching, Illegal Logging, Forest Monitoring, Arduino, Real-Time Alert System, Environmental Conservation.



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