International Journal Of Advance Research, Ideas And Innovations In Technology

VOLUME 11 - ISSUE 4

IJARIIT

SPECTRUM

International Journal of Advance Research, Ideas and Innovations in Technology

July-August, 2025

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Spectrum is an e-magazine with the comprehensive collection of all the papers that have been published in our journal over the last two months — Volume 11, Issue 4 (July-August, 2025). This edition brings together 41 papers by 60 authors from 36 institutions. Each entry links to the abstract and the full paper.

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e-ISSN 2454-132X

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ABSTRACTS

1 Myocardial Infarction with Non-Obstructive Coronary Artery (Minoca): A Systematic Review

Paper ID V11I4-1138 · Pages 1-7 · Cardiology

Richa Sinha, Student, Rayat Bahra University, Mohali, Punjab
Manroop Kaur Bajwa, Student, Fortis Escort Hospital, New Delhi

Myocardial infarction with nonobstructive coronary arteries (MINOCA), which is characterized by clinical evidence of myocardial infarction (MI) with normal or near-normal coronary arteries on angiography (stenosis 50%), continues to be a perplexing clinical entity. Recent years have seen significant progress in our understanding of this illness. It is being researched and further analyzed because the precise pathophysiology is unclear. Recommendations state that MINOCA is a group of different illnesses with a range of pathological underlying causes. Given the variety of possible pathogenic reasons, it is unclear if the conventional secondary prevention and treatment strategy for MI with obstructive coronary artery disease (MI-CAD) is the best choice for those with MINOCA. There are currently no recognized predictors or prognoses for MINOCA patients. There are currently no documented vaticinations or predictors for MINOCA cases. According to guidelines, MINOCA is a collection of many illnesses with distinct pathogenic processes. Since there are multiple possible pathological mechanisms, it isn't certain that the classical secondary forestallment and treatment strategy for MI with obstructive coronary artery complaint (MI-CAD) is optimal for MINOCA cases. Uncertainty surrounds the prognosis and predictors for the MINOCA case. Although the prognosis is slightly better for MINOCA cases than for MI-CAD cases, MINOCA is not always benign.

Keywords: Myocardial Infarction, Minoca, Myocardial Infarction with Nonobstructive Coronary Artery Stenosis, Myocarditis, Coronary Artery Disease, Atherosclerosis, Plaque Rupture, Takotsubo Cardiomyopathy, Reperfusion Therapy, Biomarkers, Microvascular Spasm, Angiography.

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2 A Study to Assess the Knowledge and Attitude Regarding Integration of Artificial Intelligence in B.Sc Nursing Curriculum among 4th Year Students of B.Sc Nursing in Selected Colleges of Nursing in the City

Paper ID V11I4-1140 · Pages 8-18 · Nursing

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To assess the knowledge regarding the integration of artificial intelligence in the nursing curriculum.To assess the attitude regarding the integration of artificial intelligence in the nursing curriculum.To correlate the level of knowledge and attitude regarding the integration of artificial intelligence in the nursing curriculum. Result: the level of Knowledge among 4th year B.Sc. Nursingstudents'' majority of the samples 50(50%) moderate knowledge, 44(44%) hava Inadequate knowledge, and 6(6%) have Adequate knowledge. the level of attitude

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among 4th year B.Sc. The majority of the nursing students ' samples, 86(86%) Positive attitudes, and 14(14%) have negative attitudes. There were 100 compressions between Comparisons between the Level of Knowledge and Attitude Regarding the Integration of AI in Nursing Curriculum. Each of them had answered 30 questions and an attitude scale. They assessed the knowledge and attitude regarding the integration of AI in the nursing curriculum among 4th year B.Sc students of B.Sc nursing, and correct answers were recorded as mean and standard deviation of the level of Knowledge and attitude. The paired t-test was applied to compare the difference between the Level of Knowledge and Attitude Regarding the Integration of AI Into Nursing Curriculum. It was found that the Level of Knowledge and Attitude Regarding the Integration of AI in the Nursing Curriculum, the paired' test value was 23.350* at the level of P 0.05. Since the P value is less than 0.05 (P value = 0.0001) difference in scores is statistically significant. The researcher concludes at a 5% level of significance and 198 degrees of freedom that the above data gives sufficient evidence to conclude that Comparison between Knowledge and Attitude Regarding Integration of AI In Nursing Curriculum, hence rejects the null hypothesis the research hypothesis.

Keywords: Artificial Intelligence, Nursing, Knowledge, Attitude, Curriculum, Education, Healthcare, Integrate, Practice, Future, Applications, Technology.

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3 A Study to Assess the Effectiveness of a Structured Teaching Programme on Knowledge Regarding Laparoscopic Transabdominal Cervical Cerclage among Fourth Year Basic B.Sc Nursing Students at Selected Nursing Colleges in the City

Paper ID V11I4-1141 · Pages 19-25 · Nursing

Bidyarani Yumnam, Principal, MGM, Institute of Nursing Education Chh.Sambhajinagar, Aurangabad, Maharashtra
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A transabdominal cerclage is highly effective in reducing both fetal loss and premature birth. It can be placed before (interval) and during pregnancy and by laparoscopic (LC) or open laparotomy (AC) procedure. The Fourth-year BSc nursing students often come in close contact with patients and know the complete obstetrics history of the woman; hence assess the knowledge regarding laparoscopic transabdominal cervical cerclage (LCTAC) among fourth-year BSc Nursing students. The objectives of the study were: 1. To assess the knowledge regarding laparoscopic transabdominal cervical cerclage. 2. To assess the effectiveness of a structured teaching program regarding laparoscopic transabdominal cervical cerclage. 3. To compare the level of knowledge between the pre-test and post-test. Students with selected sociodemographic variables. The material and methods of study were developed in the form of three sections as demographic variables, general knowledge regarding laparoscopic transabdominal cervical cerclage. The non-probability purposive sampling technique was used for selecting 60 students from nursing colleges. Results of the study indicated that findings of demographic variable reveals that, there was no one variable found statistically significant association with knowledge score about Laparoscopic Transabdominal Cervical Cerclage with selected demographic variables. The finding of the study reveals that, in the pre-test majority of the samples, 35 (58.33%), had inadequate knowledge, 25(41.66%) had Moderate knowledge, and none of the samples had adequate knowledge regarding laparoscopic transabdominal cervical cerclage. With regard s the post-test knowledge majority of the samples, 30(50%), had Moderate knowledge, 20(33.33%) had adequate knowledge, and 10(16.66%) had inadequate

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knowledge regarding laparoscopic transabdominal cervical cerclage. The study concludes that students, after receiving knowledge on Laparoscopic Transabdominal Cervical Cerclages higher knowledge scores in the post-test than pre-test. The findings of the present study indicated that nursing students have adequate knowledge regarding Laparoscopic Transabdominal Cervical Cerclages.

Keywords: Knowledge, Laparoscopic Transabdominal Cervical Cerclage, Preterm Birth, Cervical Insufficiency.

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4 AI-Powered Dashboard for SLA Monitoring and Team Performance in JIRA

Paper ID V11I4-1145 · Pages 26-27 · Computer Science – Artificial Intelligence

Arooj Javed, Independent Researcher, Queen Mary University of London, East London, England

This paper introduces a visual analytics dashboard powered by AI and Python that helps technical support teams monitor SLA compliance, ticket trends, and team performance in real time. Built for JIRA-based environments, the dashboard collects and processes ticket metadata to visualize SLA breaches, categorize ticket flows, and highlight areas of delay. Designed with open-source libraries and scalable for small to medium support teams, the solution empowers stakeholders with actionable insights, improving service delivery and operational transparency.

Keywords: SLA Monitoring, JIRA Analytics, Dashboard Visualization, Python Automation, Support Team Metrics, ITSM Intelligence, Open-Source Support Tools, AI in Customer Support

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5 Optimizing Jira-Based Support Operations With AI: A Lightweight Framework for Smart Ticket Routing and SLA Breach Prediction

Paper ID V11I4-1144 · Pages 28-29 · Artificial Intelligence

Arooj Javed, Independent Researcher, Queen Mary University of London, East London, England

This paper introduces a lightweight AI-powered framework designed to enhance technical support operations within JIRA-based environments. By integrating Python scripts and machine learning models, the system automates ticket classification based on urgency and predicts potential SLA breaches before they occur. The framework uses historical ticket data to train classification algorithms, enabling proactive routing and escalation through JIRA's REST API and Automation Rules. In real-world testing, the solution demonstrated a 34% reduction in ticket resolution time and improved SLA adherence by 40%. This approach eliminates the need for expensive plugins or enterprise licenses, making it a scalable and cost-effective automation strategy for small to mid-sized IT support teams.

Keywords: Artificial Intelligence, JIRA Automation, SLA Breach Prediction, Ticket Classification, Machine Learning, Python Integration, IT Support Automation, Workflow Optimization, Technical Support Systems, Smart Ticket Routing.

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6 Computational Study on Airfoil Flow Control Using Gurney Flap

Paper ID V11I4-1143 · Pages 30-47 · Renewable Energy - Wind Turbines - Vawts

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Enhancing the performance of airfoils can help in improving the performance of many devices such as Darrieus Vertical Axis Wind Turbines (VAWTs.) Several methods have been proposed in the literature to control the flow over airfoils. These included using Gurney flap, using leading edge flap, slotted airfoils as well as others. The Gurney flap is a fixed flap installed normal to the airfoil surface at its trailing edge. The length of the Gurney flap, its position and its orientation are important design parameters investigated in the present work. The effect of Gurney flap parameters on the lift and drag forces as well as the lift to drag ratio (glide ratio) are assessed for different angles of attack. The present study was performed using Computational Fluid Dynamics (CFD) technique. The computational model was validated and mesh sensitivity tests were carried out to ensure accurate model results. The SST k-ω model of turbulence was used to close the Reynolds averaged Navier Stokes equations. The results showed that locating the Gurney flap on the top orientation of the airfoil has bad effect on lift and drag, while locating it on the lower side improved lift to drag ratio. Based on the significance increase of the glide ratio of airfoil with Gurney flap compared to the baseline airfoil, the best length of Gurney flap is 2% of chord length and the best position of Gurney flap to be added is to the airfoil trailing edge while the best orientation of the Gurney flap is down aligned with the airfoil pressure side. The lift coefficient is increased significantly by an average of 30%, also the drag coefficient is slightly increased by an average of 15% compared to the lift and drag generated by the baseline airfoil.

Keywords: CFD, VAWT, Separation Control, Darrieus Turbine

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7 Which FDI Fuels Growth? A Comparative Analysis of Greenfield and Brownfield Investment in BRICS Economies

Paper ID V11I4-1152 · Pages 48-54 · International Finance

Akanksha Mehta, Student, University of Delhi, New Delhi

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This study investigates the differential impact of greenfield and brownfield Foreign Direct Investment (FDI) on economic growth across BRICS nations from 2003 to 2023. Recognising the discrete economic mechanisms through which each form of FDI operates, the study employs a fixed-effects panel data regression model to analyse their respective contributions to GDP per capita growth. Initial findings from the full BRICS bloc show limited statistical significance, likely arising from structural and economic heterogeneity, particularly China's status as a higher-income economy and state-directed FDI patterns, which differ markedly from the more market-driven systems of the other member countries. A refined model excluding China (focusing on the BRIS subgroup) shows that greenfield FDI has a statistically significant and positive impact on economic growth, while Brownfield FDI remains insignificant. These results highlight the importance of disaggregating FDI byentry mode to more accurately assess its developmental impact. The findings suggest that emergingeconomies may derive greater growth benefits by prioritising greenfield investments, which are more likely tostimulate capital formation, employment, and domestic linkages.

Keywords: Foreign Direct Investment, Greenfield FDI, Brownfield FDI, Economic Growth, BRICS, Panel Data Analysis, International Economics

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8 The Psychological Effects of Emotional Neglect in Childhood

Paper ID V11I4-1149 · Pages 55-59 · Pyschology

Ambika Singh, Student, St. Xavier's High School, Haryana

Childhood emotional neglect (CEN) is not a result of physical abuse or visible injury, but rather stems from a deficiency of essential emotional care and affection. This essay examines the significant and enduring effects of emotional neglect on a child's development, emotional health, and the lasting emotional trauma it inflicts. It distinguishes emotional neglect from emotional abuse by emphasising its invisibility and the psychological harm it inflicts. The study underscores that such neglect can lead to enduring feelings of unworthiness and transdiagnostic mental health disorders, including anxiety, depression, and personality disorders. The study looks at the underlying causes, which are typically the product of emotionally immature or apathetic carers. It uses scholarly research to do this. Lastly, the study claims that recovery from emotional neglect is not only achievable but also fundamental, as it encourages increased awareness, early intervention, and the validation of experiences that are frequently overlooked.

Keywords: Childhood, Emotional, Psychological Trauma, Transdiagnostic, Neglect

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9 An In-depth Analysis of the Green Architecture Movement

Paper ID V11I4-1150 · Pages 60-66 · Architecture

Guransh Singh Soni, Student, Indraprastha International School, Delhi

Green architecture produces environmental, social, and economic benefits. Environmentally, green architecture helps reduce pollution, conserve natural resources, and prevent environmental degradation. Economically, it reduces the amount of money that the building's operators have to spend on water and energy and improves

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the productivity of those using the facility. And, socially, green buildings are meant to be beautiful and cause only minimal strain on the local infrastructure. Traditional building materials are to be adapted to meet code-required standards for health and safety in contemporary buildings. Not only are they cost-effective and environmentally friendly, but when used correctly, these natural alternatives match the strength and durability of many mainstream construction materials. New building technologies, and in particular ICT automation,3d printing etc are to constantly be introduced to enhance the sustainable building process to reduce the impact of the building on the surrounding environment by using resources more efficiently (e.g. energy, water); enhancing and protecting the health and well-being of the occupants; and reducing any negative impacts.

Keywords: Sustainable, Green Architecture, Renewable Energy, Material Selection,Water Management, Climate Responsive Design

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10 On the Turning Away: A Critical Look into Brands' Engagement towards Ethics

Paper ID V11I4-1151 · Pages 67-70 · Fashion Branding

Tara Ohlan, Student, The Heritage Xperiential Learning School, Haryana

This paper takes a bird's-eye view of the prevalent and urgent misuse of the ethics of representation, with a special focus on fashion imagery in the contemporary world. Utilising a detailed literature review, the Paper looks at three specific themes: gender, race, and exoticism. It includes a critical analysis of marketing rhetoric, and questions are raised to bring into focus the cost of 'bad faith'. The Paper also explores and interprets case studies and real-life examples of how brands can market themselves, even expand their customer base, without compromising trust or ethics.

Keywords: Ethics, Race, Gender, Marketing, Colonialism, Imagery, Responsibility

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11 Mapping the Learning Path: Integrating Multi-Modal AI, Agentic AI, and MAB Reinforcement Learning to Create a Planner for Self-Paced Learning

Paper ID V11I4-1155 · Pages 71-77 · Artificial Intelligence

Varun Iyer, Student, Symbiosis Skills and Professional University, Maharashtra

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We present an intelligent, emotion-aware educational planner designed to deliver a highly personalized, self-paced learning experience. The system integrates task decomposition, graph-based reasoning, utility-driven scheduling, and affective state modeling into a cohesive, adaptive framework. High-level learner goals are broken down into actionable tasks via language models and structured into graph representations, which are analyzed using graph neural networks. A utility function—modulated by affective and cognitive state—guides task prioritization, while a contextual multi-armed bandit model dynamically schedules daily activities. The system also incorporates agentic AI to support user autonomy, mid-session adaptation, and long-term engagement. By merging planning, emotional intelligence, and explainable automation, this work proposes a modular architecture for learner-centric, holistic task management.

Keywords: Emotion-Aware Scheduling, Utility-Based Task Management, Graph Neural Networks, Affective Computing, Human-In-The-Loop AI, Multi-Armed Bandit, Agentic AI, Personalized Planning Systems, Edge AI, Task Decomposition

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12 SmartFurnace IoT: AI-Powered Monitoring and Predictive Maintenance System for DRI Kilns

Paper ID V11I4-1160 · Pages 78-79 · Iot In Industrial Automation

Aryeman Dalmia, Student, KIIT International School, Bhubaneswar, Odisha

Abstract: This paper presents SmartFurnace IoT, an intelligent system designed for real-time monitoring and predictive maintenance of Direct Reduced Iron (DRI) kilns. It integrates temperature, gas, and material flow sensors with edge devices and cloud-based AI algorithms to enhance safety, reduce downtime, and improve energy efficiency. The system provides live dashboards, automated alerts, and historical data logging, enabling proactive interventions and pollution control compliance. The approach targets cost-effective modernization of sponge iron plants, particularly in industrial regions like Odisha and Chhattisgarh.

Keywords: DRI Kiln, SmartFurnace, IoT, Predictive Maintenance, Industrial Automation, Edge Computing, Industry 4.0, Sponge Iron

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13 Employee Well-Being and Mental Health

Paper ID V11I4-1162 · Pages 80-86 · Psychology

Shreya Bhambhu, Student, IILM University

The well-being and mental health of the employees are of crucial importance to the performance, satisfaction, and productivity of the organization. This study investigates the linkages among job demands, workplace culture, organizational culture, and leadership styles on collective employee experience and performance outcomes. Increased job demands unaccompanied by matched resource availability, for instance, autonomy and social support, lead to stress-induced burnout and significant damage to commitment and efficiency. Well-desired workplace cultures have been linked to open communication, inclusiveness, and recognition, creating a culture where employees feel valued and motivated. This is reinforced by an organization-wide culture congruent with ethical leadership and employee development. Employee well-being is at the mercy of

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leadership styles, in that transformational and servant leadership facilitate motivation and growth, while the application of authoritarian and transactional styles can lead to stress and disengagement. The paper presents solutions for some of these workplace problems based on evidence. A call so made will require strategic interventions that create enabling work environments with supportive high-performance cultures. Organizations that prioritise employee well-being through balanced job demands, inclusive cultures, and effective leadership styles will enhance productivity and reduce employee turnover while creating the base for sustainable growth in the ongoing changes in workplaces.

Keywords: Employee Well-Being, Mental Health, Organizational Performance, Job Demands, Workplace Culture, Organizational Culture, Leadership Styles, Transformational Leadership, Servant Leadership, Transactional Leadership, Employee Engagement, Workplace Stress, Burnout, Productivity, Organizational Growth.

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14 Psychosomatic Manifestations of Known Psychological Disorders in Our Daily Life

Paper ID V11I4-1164 · Pages 87-89 · Psychology

Manya Gupta, Student, Lotus Valley International School

This paper investigates how mental disorders, such as anxiety, depression, and stress, are often expressed through physical symptoms such as migraines, gastrointestinal disturbances, lack of sleep, etc. The paper also examines how external influences, including hormonal fluctuations, environmental stressors, and lifestyle factors, play a critical role in affecting our psyche, which later on affects our somatic health.

Keywords: Mental Health, Psychosomatic Symptoms, Anxiety, Depression, Stress, Physical Manifestations, Hormonal Imbalance, Environmental Stressors, Lifestyle Factors, Mind-Body Connection

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15 Comparative Evaluation of Prophylactic Carbetocin versus Oxytocin in Prevention of Postpartum Hemorrhage Following Vaginal Delivery: A Randomized Controlled Trial

Paper ID V11I4-1170 · Pages 90-91 · Medical

Dr Jeena Darsan, Student, Dr. Moopen's Medical College, Kerala
Dr Amarpali KS, Professor, Dr. Moopen's Medical College, Kerala
Dr Priya S Raju, Associate Professor, Dr. Moopen's Medical College, Kerala

To compare the efficacy and safety of prophylactic carbetocin versus oxytocin in the prevention of postpartum hemorrhage (PPH) after normal vaginal delivery. Methods: This was a single-blind randomized controlled trial including 84 women undergoing vaginal delivery. Group A received 100 mcg IV carbetocin; Group B received 10 IU IM plus 10 IU IV oxytocin in 500 ml RL. Primary outcomes included postpartum blood loss and changes in hemoglobin/hematocrit levels. Secondary outcomes included the need for additional uterotonics, blood transfusions, and adverse effects. Results: Mean blood loss was significantly lower in the carbetocin group (197.36 ± 77.63 ml) compared to oxytocin (316.64 ± 107.71 ml, p=0.04). Postpartum hemoglobin and

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hematocrit decline were less significant in the carbetocin group (p

Keywords: Postpartum Hemorrhage, Carbetocin, Oxytocin, Vaginal Delivery, Randomized Controlled Trial

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16 The Impact of Costume on Performance

Paper ID V11I4-1168 · Pages 92-97 · Liberal Arts

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This research paper seeks to examine the impact of costume on dance performance. A thorough literature review is undertaken, and it is discovered that technology and dance costume design, dancing constraints depending on costumes, types of materials related to the form of dance, representation/traditions in dance costumes, and audience perception and engagement have a significant impact on dance performance. All of these factors have an interdependent and complex relationship that is examined in detail.

Keywords: Dance, Costume, Technology, Fashion, Audience, Performance

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17 Time Hierarchy in Practice: Empirical Evidence of Computational Class Separations

Paper ID V11I4-1174 · Pages 98-107 · Computer Science

Aarush Reddy, Student, Indus International School

The Time Hierarchy Theorem states, in theory, that by providing more time, there exist strictly more problems that can be solved. However, most of these separations are very abstract and cannot be seen in a real computing environment. This paper investigates how algorithmic classes of different time complexities act under real-world time constraints. It does this by empirically evaluating standard algorithms with time complexities from O(n log n) to $O(2^n)$ and measuring the input sizes at which effective divergence is observed. The paper finds effective and observable diversions in line with theoretical expectations, empirically supporting theoretical hierarchies.

Keywords: Time Complexity, Class Separations, Hierarchy

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18 Decentralized Document Verification by Smart Contracts: Lightweight Open-Source Solution Design and Implementation

Paper ID V11I4-1177 · Pages 108-111 · Blockchain Technology

Kyrylo Sotnykov, Independent Researcher

With the current digital era, document authenticity and existence verification become increasingly valuable across industries, including legal services, intellectual property protection, and business regulation. Authenticity and existence verification via conventional methods is usually centralized and entity-dependent,

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which may introduce privacy concerns, points of failure, and extra expenses. This paper presents the design and construction of a decentralized document verification system as an open-source system using blockchain smart contracts to safely register cryptographic proofs of digital material. The solution emphasizes ease, privacy, and usability using just smart contracts without storing actual document information on-chain or off-chain. By allowing users to calculate cryptographic hashes locally and directly interact with the blockchain, the system preserves immutable, transparent, and verifiable records while not compromising on confidentiality.

Keywords: Blockchain, Smart Contracts, Document Verification, Data Integrity, Decentralized Applications, Web3, Cryptographic Hashes

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19 Experimental Study on the Mechanical Properties of Concrete Using GGBS and Pond Ash with Glass Fiber Reinforcement

Paper ID V11I4-1189 · Pages 112-118 · Concrete Technology

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Sabir Khan, Research Scholar, Shri Shankaracharya Institute of Professional Management and Technology, Raipur, Chhattisgarh
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Concrete is the most widely used construction material globally due to its versatility, durability, and cost-effectiveness. However, the production of conventional concrete requires a substantial amount of cement and sand, which leads to environmental concerns and depletion of natural resources. In the present study, an attempt has been made to prepare the sustainable concrete using partial replacement of cement with GGBS and sand by pond ash with glass fiber. The cement and sand have been replaced by 20% and 40% by GGBS and pond ash, respectively. A constant proportion of fiber (0.1% of cement) is added to evaluate the combined effect on properties of concrete. The experimental tests on fresh concrete (i.e., workability) and hardened concrete (i.e., compressive strength test, flexural strength test, and ultrasonic pulse velocity test) were performed to study the effect of partial replacement of GGBS and pond ash in the concrete. Based on durability, replacement of 20% cement up to 40% sand is recommended by GGBS and pond ash, respectively, together with glass fiber.

Keywords: Ggbs, Pond Ash, Glass Fiber, Compressive Strength, Flexural Strength, Ultrasonic Pulse Velocity

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20 Towards Inclusivity: An Analysis of the National Education Policy 2020’s Potential to Address the Educational Needs of Marginalised Groups

Paper ID V11I4-1183 · Pages 119-127 · Developmental Economics

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The National Education Policy (NEP) 2020 represents a paradigm shift in India’s educational landscape,

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promising equity, inclusivity, and quality for all. Falling into the paradigm of developmental economics, this paper critically examines the policy's potential to address the needs of historically marginalized communities—including socio-economically disadvantaged groups (SEDGs), Scheduled Tribes, children with disabilities, and gender minorities—through a focused analysis of key provisions such as Early Childhood Care and Education (ECCE), Special Education Zones, the Gender-Inclusion Fund, and Open and Distance Learning (ODL). Drawing upon official policy documents, existing educational statistics, and the broader socio-political context, this study evaluates whether NEP 2020 offers not just symbolic inclusion but substantive structural change. The paper argues that while the NEP makes commendable strides in intent and policy design, its success depends critically on effective implementation, inter-sectoral coordination, and sustained financial commitment. By highlighting both the strengths and gaps within NEP 2020, this analysis aims to contribute to ongoing discourse on educational equity and inform future policy refinements to better serve India's most vulnerable learners.

Keywords: Developmental Economics, NEP 2020, Education Policy, Marginalised Communities, Inclusive Education, India, Socio-Economic Disadvantage

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21 Gender, Violence, and Memory in Meena Alexander'S Nampally Road

Paper ID V11I4-1186 · Pages 128-130 · English Langauge

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Meena Alexander's Nampally Road (1991) is a powerful postcolonial feminist novel that weaves together themes of gender, violence, and memory within the socio-political landscape of contemporary India. Set in Hyderabad, the novel explores the psychological and physical trauma inflicted upon women by systemic patriarchal and political violence. This research paper analyzes Nampally Road as a literary site where female subjectivity, resistance, and memory converge to critique both colonial and postcolonial structures of oppression. Drawing on feminist and postcolonial theories, the study interrogates how Alexander constructs her female protagonist Mira's journey as emblematic of the broader struggles faced by Indian women. The novel ultimately becomes a space for reimagining justice, healing, and agency in the face of deeply rooted violence.

Keywords: Meena Alexander, Nampally Road, Gender Violence, Memory, Postcolonial Feminism, Trauma, Resistance

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22 Empowering Indian Educators through AI: Transforming Faculty Development and Pedagogical Practices in Higher Education

Paper ID V11I4-1188 · Pages 131-135 · Commerce & Management

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The rapid integration of Artificial Intelligence (AI) into education systems is redefining teaching and learning paradigms across the globe. In India, with the rollout of the National Education Policy (NEP) 2020 and the push for digital transformation, AI holds the potential to completely change faculty development and pedagogical

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practices in higher education. This research investigates the impact of AI-based tools on Indian educators, focusing on personalized teaching, adaptive learning systems, and data-driven decision-making. The study examines how AI technologies empower faculty through continuous upskilling and reskilling, enabling them to adapt to evolving learning environments. Using AI-driven Learning Management Systems (LMS), teachers can now access real-time analytics, automate assessments, and personalize student feedback. However, the adoption of these technologies depends on institutional readiness, faculty digital literacy, and infrastructure availability. A structured questionnaire was distributed to 100 faculty members across Indian universities. The data was analyzed using SPSS tools, including percentage analysis, multiple regression, and chi-square analysis. The study identifies eight key factors influencing faculty empowerment: digital literacy, institutional support, training programs, AI integration in LMS, perceived usefulness, ease of use, policy awareness, and resistance to change. Results reveal a strong correlation between AI adoption and enhanced teaching effectiveness. Faculty members exposed to AI tools demonstrated increased engagement, better course customization, and improved student performance metrics. However, challenges such as lack of AI training, fear of redundancy, and inadequate infrastructure remain. The study emphasizes the need to implement structured AI competency programs and clear policy directives under NEP 2020. This research contributes to ongoing discourse by offering a faculty-centric perspective on AI adoption in Indian higher education. It offers concrete recommendations for policymakers, academic leaders, and EdTech developers to collaboratively design future-ready academic ecosystems.

Keywords: Artificial Intelligence, Faculty Development, Personalized Learning, AI in Education, NEP 2020, Learning Management Systems, Pedagogical Innovation, Higher Education, India

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23 MediNav: An AI-Driven Specialist Referral Tool to Reduce Wait Times in Indian Public Hospitals

Paper ID V11I4-1191 · Pages 136-139 · Computer Science & Engineering

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Public hospitals in India face significant challenges with long patient wait times, particularly due to disorganized referral systems. Many patients approaching these hospitals come from underserved backgrounds or have limited health literacy and often struggle to identify the appropriate type of doctor for their specific health issues. As many public hospitals in India lack a structured first point of contact or General Practitioner (GP) system, this confusion contributes to unnecessary delays and increased wait times. To address this issue, the study introduces MediNav, an AI-powered tool designed to evaluate patient symptoms and guide them to the right type of doctor for consultation. By doing so, MediNav enhances patient flow and minimizes unnecessary delays, particularly benefiting those who may not know how to navigate the healthcare system. The AI model, developed using XGBoost on symptom–specialty data, achieved an overall accuracy of 85.58% in live primary healthcare (PHC) settings. Through a comparative assessment of wait times, MediNav has the potential to reduce patient waiting time stemming from misreferrals or department transfers by an average of 39.4 minutes per individual in public Indian hospitals. In the absence of a GP or structured referral layer, such inefficiencies are common in India’s public hospitals. With typical patient volumes of 500 or more per day, this translates to over 328 clinical hours saved daily. This significant reduction can enhance clinical efficiency within strained

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public health systems, ultimately improving access to care for all patients, especially those with limited understanding of the healthcare process.

Keywords: Patient Triage, Indian Hospital Waiting Time, Symptom-Based Routing

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24 Exploration of Biosurfactant Producing Microorganism from Garage Soil: Production, Characterization, and its Application

Paper ID V11I4-1200 · Pages 140-148 · Microbiology

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Biosurfactants are bioactive surface molecules produced by microorganisms, gaining notoriety for their environmentally friendly and biodegradable characteristics. This research emphasizes the extraction, production, and analysis of biosurfactants from hydrocarbon-polluted soils collected from a garage and truck terminal in the Yeshwanthpur industrial region. The samples were enriched using Mineral Salt Medium (MSM), and bacterial strains were isolated through serial dilution and pour plate methods. The identification of biosurfactant-producing bacteria was performed utilizing drop collapse, oil displacement, and emulsification assays. Among the isolates, isolate 2 exhibited the most promising results and was chosen for further research. Gram staining, endospore staining, and biochemical tests revealed the organism to be Bacillus cereus. Optimization of biosurfactant production was achieved by adjusting pH, temperature, incubation duration, inoculum volume, and nutrient sources. The maximum biosurfactant yield was attained with 250 µl of inoculum and with optimum physical parameters of pH 6 and temperature 35°C at a 24-hour incubation period, with glucose and peptone as carbon and nitrogen sources, respectively. The biosurfactants were extracted through acid precipitation followed by solvent extraction using chloroform and methanol. The characterization of the crude biosurfactant was performed. The antimicrobial properties against selected bacterial and fungal strains were assessed using the agar diffusion method, and bioremediation potential was evaluated. Distinct zones of inhibition confirmed the antimicrobial efficacy of the biosurfactant. These results imply that Bacillus cereus isolated from garage soil contains effective biosurfactant-producing potential and can be used in environmental bioremediation and antimicrobial property, offering a sustainable substitute for synthetic surfactants.

Keywords: Biosurfactants, Antimicrobial Properties, Bioactive Compounds, Bioremediation, Biodegradability.

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25 A Network Security Monitoring System using Deep Learning

Paper ID V11I4-1201 · Pages 149-157 · Intrusion Detection Systems (ids) And Network Threat Detection

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In an era of evolving and increasingly complex cyber threats, the importance of robust network security is paramount. This paper presents a novel method of strengthening network defenses by building a highly flexible and durable Network Security Monitoring System (NSMS). By utilizing deep learning, more especially self-taught learning (STL), we set out to reinvent network security. In this study, we apply STL to the well-known NSL-KDD dataset, which is a commonly used network security monitoring system benchmark. We thoroughly analyze our NSMS solution's performance utilizing a range of important metrics, such as accuracy, precision, recall, and F-measure, to determine its overall effectiveness. Impressively, this method produced a 92.84% accuracy on the training set. As we use both the training and testing datasets in our work, our research expands on this basis and provides a distinct advantage for comparison, allowing a straight comparison to this earlier work. This study's main importance comes from its ability to prevent intentional attacks and to proactively identify unanticipated and unforeseeable security breaches. This research represents a milestone in the development of NSMS technology in the dynamic cybersecurity landscape, enabling enterprises to strengthen their security posture and protect their assets in a world that is becoming more interconnected.

Keywords: Intrusion Detection, Network securing, Strengthening Network, Security Monitoring System.

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26 Neonatal Alloimmune Thrombocytopenia (NAIT): A Comprehensive Review

Paper ID V11I4-1206 · Pages 158-165 · Medicine

Aadya Gaur, Student, Independent Researcher

Neonatal Alloimmune Thrombocytopenia (NAIT) is a rare but potentially life-threatening condition in which maternal alloantibodies target fetal platelet antigens, leading to severe thrombocytopenia, bleeding complications, and, in some cases, intracranial hemorrhage (ICH) or fetal demise. This review provides a comprehensive exploration of NAIT’s pathophysiology, immunologic mechanisms, genetic predispositions, clinical manifestations, diagnostic approaches, and evolving prevention and treatment strategies. Special emphasis is placed on the immunogenetic triggers, particularly Human Platelet Antigen (HPA) incompatibilities, and their population-specific prevalence. Diagnostic techniques such as MAIPA and HPA genotyping are highlighted alongside current antenatal interventions, including intravenous immunoglobulin (IVIG), corticosteroids, and antigen-negative platelet transfusions. Advances in population-based screening, noninvasive fetal genotyping, and consensus guidelines have significantly improved outcomes, reducing ICH rates and enhancing survival. Despite these advances, long-term neurodevelopmental sequelae remain a concern, even in nonhemorrhagic cases. This review integrates recent epidemiologic and clinical findings from 2023 to 2025, emphasizing the growing importance of early recognition, targeted management, and

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international consensus in improving care for NAIT-affected neonates and future pregnancies.

Keywords: NAIT, Thrombocytopenia, HPA Incompatibility, IVIG, Neurodevelopmental Sequelae.

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27 Airport Runway Obstacle Detection and Analysis from UAV Imagery: A Review Using the Stanford Drone Dataset

Paper ID V11I4-1205 · Pages 166-177 · Electronics & Communications Engineering

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Maintaining obstacle-free runways is an essential part of airport operations and aviation safety. The growing availability of high-resolution imagery from UAVs, especially from publicly available datasets like the Stanford Drone Dataset (SDD), presents new challenges and opportunities for innovative obstacle detection systems. This paper provides a systematic methodological overview of airport runway obstacle detection from UAV imagery with emphasis on methods transferable to the SDD. This methodology examines cutting-edge computer vision methods, among them object recognition models like YOLO, Faster R-CNN, and Vision Transformers, and their theoretical potential for recognizing common runway hazards like cars, people, and foreign object debris (FOD). The review also contains a thorough analysis of the SDD's architecture, objects, resolution, and limitations relative to runway conditions. We also introduce a conceptual pipeline for real-time obstacle detection and discuss its possible incorporation into airport safety management systems. Lastly, this review determines the main research gaps and presents future research directions for enhancing obstacle detection accuracy, real-time performance, and adaptability to varied airport environments. This work intends to provide a basis for future experimental studies and system development utilizing UAV-based imagery for airport runway safety.

Keywords: Uav Imagery, Runway Obstacle Detection, Stanford Drone Dataset, Airport Safety, Computer Vision, Foreign Object Debris (Fod)

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28 The Economics of Food Insecurity

Paper ID V11I4-1210 · Pages 178-184 · Economics

Yuvan Gupta, Student, R N Podar School, Mumbai

Why does India struggle with food insecurity despite being one of the world's largest food producers, and what does this reveal about the real drivers of hunger? Despite advancements in agricultural productivity and food-related welfare schemes, food insecurity continues to infest India, exposing deep-rooted systemic inefficiencies and socio-economic disparities. This paper contributes by emphasizing the qualitative aspects of food security, such as distribution, utilization, and socio-economic access, rather than focusing on just the quantitative aspects like production and price indices. Using secondary research and data from governmental, academic, and institutional sources, this paper explores the intertwined nature of income disparity, nutritional inequality,

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and inflation along with supply chain inefficiencies and how it affects food security, particularly in India. Ultimately, it argues that food security is not a singular agricultural or economic issue but a multi-dimensional challenge that demands both immediate policy rectification and long-term structural transformation. The question in this research paper is answered by taking into consideration a hypothesis that food insecurity in India is not a result of food scarcity but stems from systemic failures in distribution, deep-rooted socio-economic inequalities, and inconsistent policy implementation.

Keywords: Food Security, India, Income Inequality, Malnutrition, Supply Chain Inefficiencies, Food Inflation, Public Distribution System, Socio-Economic Disparities.

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29 How Could We Add Emotional Nuances to AI-Generated Music?

Paper ID V11I4-1212 · Pages 185-193 · Computer Science

Moaksh Kakkar, Student, Bennett University, Uttar Pradesh

In recent years, artificial intelligence (AI) has made significant progress in generating music using architectures such as RNNs, Transformers, GANs, VAEs, diffusion models, and large language models. Although these models are capable of generating structurally coherent and stylistically accurate music, they tend to lack the subtle emotional nuance and depth of human music. This paper examines the idea of emotional nuance—the ability of AI-generated music to express subtle variations, mixed effects, changing affective trajectories, and selective emotional impact. Combining theories from music psychology, affective computing, and computational creativity, I translate musical features like tempo, mode, harmony, dynamics, articulation, timbre, and melodic contour into their perceived emotional counterparts. I survey and compare methods of emotional control, ranging from conditional generation and reinforcement learning with affective rewards to employing music theory and hybrid symbolic–neural methods. I present key challenges, including the subjective nature of emotional perception, limitations in datasets, cultural variability, and the challenge of quantifying nuanced affect. I also outline directions for future work around more robust datasets, culturally adaptive models, cognitively inspired emotion representations, interpretable control mechanisms, and sound evaluation frameworks. By refining these strategies, AI music systems can move closer to being not just pattern generators but creative collaborators able to express genuine emotion.

Keywords: AI Music Generation, Emotional Nuance, Affective Computing, Music Psychology, Valence-Arousal Model, Reinforcement Learning, Large Language Models, Generative Models, Music Theory Integration, Computational Creativity.

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30 Challenges Faced by Micro and Small Firms and Disparities of Firm Growth in India

Paper ID V11I4-1214 · Pages 194-197 · Economics

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Microenterprises form the backbone of rural India's economic environment, but their access to formal financial sources remains limited due to inadequate documentation, low financial literacy, and credit risks. In the

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absence of formal sources of credit, these enterprises are compelled to turn to informal credit sources such as moneylenders, local traders, and friends and family to meet their financial needs. This research paper explores the various challenges microenterprises face in acquiring required credit, including high interest rates and lack of security. An important factor is the problem of rent-seeking behavior expressed by various sources of credit, from individuals to local authorities, which increases borrowing costs and increases inequities. Using firsthandexperiences, case studies, and data analysis, this study identifies patterns of firm growth and unequal growth that display credit access in rural informal markets. The findings highlight the urgent need for government interventions and the expansion of accessible and affordable financial services specific to the unique challenges faced by rural microenterprises.

Keywords: Micro and Small Enterprises, Challenges Faced by Small Firms, Rural and Urban Divide, State-Wise Distribution, Solutions to Restricted Firm Growth, Rent Seeking.

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31 Overview of the Use of Hydrogen Fuel Cells in the Maritime Sector

Paper ID V11I4-1215 · Pages 198-204 · Enviromental Engineering

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Abstract The maritime industry, responsible for 80% of all global trade and 3% of all greenhouse gas emissions, has been aiming for decarbonization for decades. With the International Maritime Organisation (IMO) aiming for net-zero carbon emissions by 2050, the implementation of the use of eco-friendly fuel and technologies has fast established itself as a priority. Hydrogen fuel cells, a new technology facing research and development, are one such alternative fuel source that has zero-carbon emissions. This paper presents a technological overview of the types of hydrogen fuel cells, the ship structural requirements for their storage and transport, the challenges associated with implementing this technology, and examples of ships currently using hydrogen fuel cells. Also provided is an in-depth analysis of hydrogen fuel cells with alternative fuels like ammonia and biofuel and with fossil fuels like heavy fuel oil (HFO) and liquified natural gas (LNG).

Keywords: Hydrogen, Hydrogen Fuel Cells, Maritime Sector, Decarbonization, Types of Fuel Cells, Comparison of Fuels, Ship Requirements.

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32 AI-Enabled Forest Fire Detection and Automated Response Systems: An Integrated Technological Solution for Early Suppression and Biodiversity Protection

Paper ID V11I4-1219 · Pages 205-207 · Computer Science

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Forest fires have long been a significant threat to ecosystems, biodiversity, and climate stability around the world. The increasing scale and severity of these events, exacerbated by climate change, highlight the need for advanced prevention and response systems. Traditional manual firefighting measures are often delayed, leading to catastrophic outcomes. This paper proposes an original AI-enabled fire response system that

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combines in-forest sensor networks with automated water or fire extinguishing solutions, aiming for rapid, localized response. Employing smoke sensors and machine learning algorithms, the system detects early fire signs and instantaneously activates localized suppression mechanisms to prevent spread. This research addresses the design, operation, and potential effectiveness of such a system, drawing on literature, technological assessments, and simulations. The findings suggest that AI-driven integrated systems can dramatically enhance early fire suppression and lessen environmental, economic, and health impacts.

Keywords: Artificial Intelligence, Forest Fires, Automated Fire Suppression, Sensors, Climate Change, Biodiversity, Early Detection.

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33 Artificial Intelligence in Aviation: Enhancing Efficiency, Safety, and Sustainability

Paper ID V11I4-1165 · Pages 208-214 · Aviation

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The aviation industry globally is bogged down by punctuality, cost pressure, customer satisfaction, safety & reliability. The continued growth of this industry requires solutions that optimize flight performance, bring down operating costs, maintains safety and meets customer satisfaction. This paper explores the application of AI in optimizing routing, predictive maintenance, simulating real-life situations for training, passenger experience, and its role in the current and future of the aviation industry.

Keywords: Aviation, Artificial Intelligence, Machine Learning, Big Data, Aviation Accidents, Strategy.

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34 Unregulated Chit Funds in India: Risks, Loopholes, and the Need for Policy Reform

Paper ID V11I4-1218 · Pages 215-219 · Economics & Finance

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Chit funds, a conventional and prevalent financial mechanism in India, remain crucial in facilitating access to savings and credit, particularly for low-income people and in areas with inadequate formal banking infrastructure. Despite being governed by the Chit Funds Act of 1982, there is no single pan-Indian regulatory authority, and implementation and monitoring are still dispersed throughout the states. The growth of unregistered and informal chit funds, many of which function without accountability or transparency, has been made possible by this decentralisation. Driven by persuasive agents and trust-based networks, social engineering frequently persuades people to engage in chit schemes without fully comprehending the hazards, especially in rural and semi-urban settings. The interest rates in chit funds, especially for early bidders, are often not economically feasible in the long term, resembling high-cost borrowing rather than profitable investments. Moreover, the returns are variable and contingent upon bidding dynamics and member defaults, exposing participants to systemic risks. Despite their popularity, financial literacy surrounding chit funds remains low at the grassroots level, leading to poor decision-making and increased vulnerability to fraud. This

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paper explores how the interplay of weak regulation, social trust networks, and limited financial awareness perpetuates the risks within the chit fund ecosystem, emphasising the urgent need for stronger national oversight and grassroots-level financial education.

Keywords: Financial Literacy, Informal Finance, Unregistered Chit Schemes, Social Engineering, Regulatory Oversight, Financial Fraud, Regional Disparities, Socioeconomic Vulnerability, Credit Risk Assessment.

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35 Optimal Material Selection for Injection Moulding Die

Paper ID V11I4-1208 · Pages 220-233 · Mechanical Engineering

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Choosing the right material for making injection molding dies is very important, as it affects how well the mold performs, how long it lasts, and how much it costs to maintain. Since the die goes through high pressure and temperature again and again during each molding cycle, it must be made of strong materials that can handle heat, resist wear, and stay dimensionally stable. In this study, I looked into the important factors to consider while selecting the die material, like mold life, how easy it is to machine, resistance to corrosion, and how well it works with different types of plastic. Some commonly used materials like P20 tool steel, H13 tool steel, and beryllium copper alloys are compared based on their properties and usage. I have also included details about special coatings and surface treatments that improve the life and performance of these materials. Overall, with proper material selection based on both technical and cost aspects, manufacturers can improve efficiency, reduce downtime, and increase the lifespan of injection molds.

Keywords: Injection Moulding, Die Material Selection, Tool Steels, H13 Steel, P20 Steel, 718 Alloy, 2378 Alloy, Nak80, S7 Steel, Dear Method, Data Envelopment Analysis, Multi-Criteria Decision Making, Thermal Conductivity, Wear Resistance, Machinability, Mold Performance, Material Comparison, Mold Life, Manufacturing Efficiency.

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36 Predictive Crop Yield Modeling with AI and IoT for Efficient Supply Chain Management

Paper ID V11I4-1222 · Pages 234-237 · Agriculture

Jairaj Sander, Research Scholar, Punjabi University
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Efficient supply chain management is critical for improving the profitability and sustainability of agricultural produce in Punjab, India. Traditional systems often suffer from inefficiencies such as post-harvest losses, poor market linkages, and lack of real-time information flow. Artificial Intelligence (AI) and Internet of Things (IoT) technologies provide opportunities to optimize these processes by enabling predictive analytics, real-time monitoring, and smart decision-making.

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Keywords: Artificial Intelligence, Internet of Things, Agriculture, Supply Chain, Punjab, Smart Farming

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37 Performance Evaluation of Concrete with Steel Slag as Cement Replacement and Pond Ash as Fine Aggregate Replacement

Paper ID V11I4-1226 · Pages 238-245 · Concrete Technology

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The present study investigates the potential of incorporating steel slag (SS) as a partial replacement for cement and pond ash (PA) as a partial replacement for fine aggregates in the development of sustainable concrete. This approach addresses the dual objective of reducing the overconsumption of ordinary Portland cement and natural river sand while providing an eco-friendly disposal route for abundantly available industrial by-products. A comprehensive experimental program was conducted to evaluate the effects of SS and PA on workability, compressive strength at 7, 14, and 28 days, flexural strength, and ultrasonic pulse velocity (UPV). The results revealed that the workability decreased with increasing PA content, while SS up to 20% maintained acceptable slump values. In terms of mechanical performance, SS demonstrated a positive impact, with SS10PA0 achieving the maximum compressive strength of 42 MPa, flexural strength of 5.0 MPa, and UPV of 4.75 km/s, all exceeding the control mix values. Higher PA contents (>20%) resulted in significant reductions in strength and quality indices, indicating its limited applicability as a standalone material. However, combined mixes such as SS10PA10 and SS20PA10 exhibited compressive strength and durability parameters above the target strength, confirming their suitability in practical applications. To optimize performance, a Response Surface Methodology (RSM)-based quadratic regression model was developed for predicting flexural strength using compressive strength and UPV as input variables. The model showed a strong correlation ($R^2 = 0.94$) with experimental data, highlighting its reliability in predicting concrete performance and reducing reliance on extensive destructive testing. Overall, the study concludes that the judicious incorporation of steel slag up to 20% and pond ash up to 10–20% offers an optimum balance of strength, durability, and workability. The findings establish a viable pathway for utilizing industrial by-products in concrete production, contributing to sustainable construction practices and resource conservation.

Keywords: Steel Slag, Pond Ash, Compressive Strength, Flexural Strength, Ultrasonic Pulse Velocity, RSM.

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38 An Analysis of GST and its Impact on MSMEs in India with Canada as a Control

Paper ID V11I4-1227 · Pages 246-250 · Economics

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This research paper delved deeply into the benefits and challenges that micro, small, and medium enterprises faced with the implementation of GST in their respective countries. The research paper took a special interest in India and Canada as comparative territories. Furthermore, we discussed the history of GST and its impact on MSMEs in their respective countries and ultimately commented on whether GST was a boon or a bane in each of these countries.

Keywords: GST, MSMEs, Tax, India, Canada, Value-Added Tax, Business, Dual GST System.

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39 Experimental Study on Concrete with Partial Replacement of Cement with Rice Husk and Bentonite

Paper ID V11I4-1233 · Pages 251-260 · Civil Engineering

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The growing emphasis on sustainable construction has led to the exploration of alternative materials to partially replace cement in concrete, reducing environmental impact and enhancing performance. This study investigates the effects of partial replacement of cement with rice husk ash (RHA) and bentonite in concrete, focusing on its mechanical properties, durability, and microstructural characteristics. RHA, a byproduct of rice milling, is rich in amorphous silica and exhibits excellent pozzolanic properties, while bentonite, a naturally occurring clay, enhances workability and contributes to improved resistance against permeability and cracking. In this experimental study, cement was partially replaced with RHA at 5%, 10%, and 15% and bentonite at 5%, 10%, and 15% in different mix proportions. The concrete specimens were evaluated for workability, compressive strength, tensile strength, water absorption, and durability characteristics over curing periods of 7, 28, and 56 days. Additionally, durability tests are conducted, such as acid resistance and sorptivity. This study demonstrates the potential of RHA and bentonite as sustainable alternatives to cement in concrete, reducing carbon emissions while enhancing mechanical performance. The findings provide insights into optimizing concrete mix design for sustainable construction applications. Further research is recommended to assess long-term durability and field applications of RHA- and bentonite-based concrete.

Keywords: Concrete, Rice Husk Ash, Bentonite, Sustainable Construction, Partial Cement Replacement, Pozzolanic Reaction, Durability, Microstructure.

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40 Performance Evaluation of High-Performance Fiber-Reinforced Concrete for Canal Lining Applications

Paper ID V11I4-1232 · Pages 261-274 · Civil Engineering

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The growing demand for sustainable water management and efficient irrigation systems has underscored the importance of durable and long-lasting canal lining materials. Conventional concrete linings often suffer from issues such as cracking, abrasion, water seepage, and reduced service life, especially in regions subjected to harsh environmental and hydraulic conditions. This study focuses on the development and performance evaluation of High-Performance Fiber-Reinforced Concrete (HPFRC) specifically designed for canal lining applications. The primary objective of this research is to enhance the mechanical properties, impermeability, and crack resistance of canal lining materials by incorporating various types of fibers—such as steel fibers, polypropylene fibers, and hybrid combinations—into high-performance concrete mixes. The investigation includes a comprehensive analysis of the workability, compressive strength, flexural strength, tensile strength, water absorption, shrinkage, and erosion resistance of the developed concrete mixes. In addition, a comparative study is conducted between conventional concrete and HPFRC under simulated field conditions, including wet-dry cycles, thermal variations, and flowing water erosion. The findings of this research are expected to demonstrate that HPFRC offers significant improvements in structural integrity, service life, and impermeability, making it a superior material for modern canal lining projects. The study also discusses the economic and environmental feasibility of using fiber-reinforced high-performance concrete on a large scale, with potential benefits in water conservation and reduction of maintenance costs. This work aims to provide a scientific basis and practical guidance for engineers and policymakers involved in the design and construction of durable and sustainable canal infrastructure, especially in water-scarce and agricultural regions.

Keywords: Concrete, High-Strength Concrete, Steel Fiber, Sustainable Construction, Polypropylene, Pozzolanic Reaction, Durability.

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41 Analytical Electrochemical– Mechanical Simulation Model for Lithium-Ion Pouch Cells Under External Load

Paper ID V11I4-1231 · Pages 275-282 · Mechanical Engineering Electric Vehicles

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The performance of lithium-ion pouch cells is significantly affected by external mechanical loads in addition to electrochemical operating conditions. This study presents a simplified electrochemical-mechanical model to analyze the influence of compressive forces on a 19.6 Ah lithium-ion pouch cell. External loads are translated

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into strain using a stiffness-based formulation, which is further linked to porosity variation, capacity fade, and internal resistance rise. A voltage model incorporating open-circuit voltage and ohmic drops is used to simulate discharge characteristics under different charge/discharge rates (0.25C, 0.5C, and 1C) and mechanical loads (0–8 kg). Simulation results indicate that increasing load leads to reduced capacity and elevated resistance, with the effect becoming more pronounced at higher C-rates. Quasi-open circuit voltage (Quasi-OCV) comparisons further reveal measurable shifts in voltage–SOC profiles before and after loading. The proposed framework provides a computationally efficient and adaptable tool for exploring electrochemical–mechanical interactions, offering valuable insights for battery design, safety, and performance optimization.

Keywords: Lithium-Ion Pouch Cell, Electrochemical–Mechanical Coupling, External Mechanical Load, Capacity Fade, Battery Performance Simulation.

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Volume 12, Issue 6 (November-December, 2026) is open for submissions. Last date: 31st December, 2026.

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