4th International Conference on

Recent Advances in Sustainable Environment

December 5 - 6, 2025

Organized by

Shobhit University

EDUCATION EMPOWERS

NAAC Accredited with Grade A

An event of STEM-RS

Editors

Prof. (Dr.) Rajiv Dutta

Dr. Divya Prakash

Dr. Om Prakash Verma

Dr. Tarun K. Sharma

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RAiSE2025

Recent Advances in Sustainable Environment (RAISE2025)

December 5 – 6, 2024 || Shobhit University, Gangoh, U.P., INDIA

Theme of the Conference

Environmental Sustainability: Healthcare, Soil conservation and Water; Food and Environmental Legislation; Renewable Energies; Waste and recycled materials, Civil infrastructure, and Environmental geotechnologies

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RAiSE2025

About RAiSE2025

Recent Advances in Sustainable Environment (**RAiSE)** is one of the leading international conferences for presenting novel and fundamental advances in the fields of Sustainable Environment. It also serves to foster communication among researchers and practitioners working in a wide variety of scientific areas with a common interest in improving Sustainable Environment and related techniques.

RAiSE is dedicated to bringing together a significant number of diverse scholarly events for presentation within the conference program. Events will run over a span of time during the conference depending on the number and length of the presentations. With its high quality, it provides an exceptional value for students, academics and industry researchers.

RAiSE aims to bring together leading academic scientists, researchers, and research scholars to exchange and share their experiences and research results on all aspects of Advances in Sustainable Ecological Engineering and Design. It also provides a premier interdisciplinary platform for researchers, practitioners, and educators to present and discuss the most recent innovations, trends, and concerns as well as practical challenges encountered, and solutions adopted in the fields of Advances in Sustainable Ecological Engineering and Design.

First in the series, **RAiSE 2022**, was jointly organized by Shobhit University Gangoh and Shobhit Institute of Engineering & Technology (Deemed to be University) Meerut and in technical collaboration with Dr B. R. Ambedkar National Institute of Technology Jalandhar, INDIA and supported by STEM-Research Society during February 26-27, 2022. The **second RAiSE2023** was organized at Bundelkhand University Jhansi in May 15 – 16, 2023 in hybrid mode and supported by STEM-Research and Council of Science and Technology, U.P. Department of Science and Technology, Govt. of U.P., India. **Third** RAISE2024 was organized by Himachal Pradesh University and supported by STEM-Research Society during November 22 - 23, 2024.

Fourth International Conference on Recent Advances in Sustainable Environment (RAiSE 2025) is organized at Shobhit University, Gangoh, Saharanpur (accredited with a NAAC 'A' grade) in technical collaboration with Dr B. R. Ambedkar National Institute of Technology Jalandhar, INDIA and supported by STEM-Research Society during December 5-6, 2025.

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Theme of the Conference – RAiSE2025

It is one of the leading international conferences for presenting novel and fundamental advances in the fields of Sustainable Environment. It also serves to foster communication among researchers and practitioners working in a wide variety of scientific areas with a common interest in improving Sustainable Environment and related techniques.

Thrust Areas: Sustainable Chemistry and Pharmacy; Bioinformatics; Biotechnology; Chemistry for the Environment; Supply Chain Management; Marketing; Finance; Human Resource Management; Sustainable IT; Solutions in Construction & Civil Engineering; Sustainable Agriculture; Agriculture Practices & Their Management; Sustainable Materials and Processing; Renewable Energy and Sustainable Environment; Sustainable Mechanical Systems and Techniques; Social Environment and Engineering Education Policy for Sustainable Development; Sustainable Design and Decision Making; Fuzzy Logic in Sustainable Development; Fuzzy Logic in Renewable Energy Systems; Machine Learning and Deep Learning in Agriculture System; Sustainability Solutions in any domain; Political sustainability; Sustainable Art; Sustainable Transportation; Healthcare, Soil conservation and Water; Food and Environmental Legislation; Renewable Energies; Waste and recycled materials; Civil infrastructure; and Environmental geotechnologies; Green Building / Eco-Architecture; Sustainable Agriculture (organic farming, permaculture); Natural Resource Management; Eco-Tourism; Pollution Control; Carbon Footprint; Human Rights & Environment Law; Rights of Nature; Cost-benefit analysis for sustainable initiatives; Financial and Economic Management for Sustainability; Stakeholder engagement and communication; Environmental Policy and Governance; Environmental laws and compliance

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About Shobhit University, Gangoh

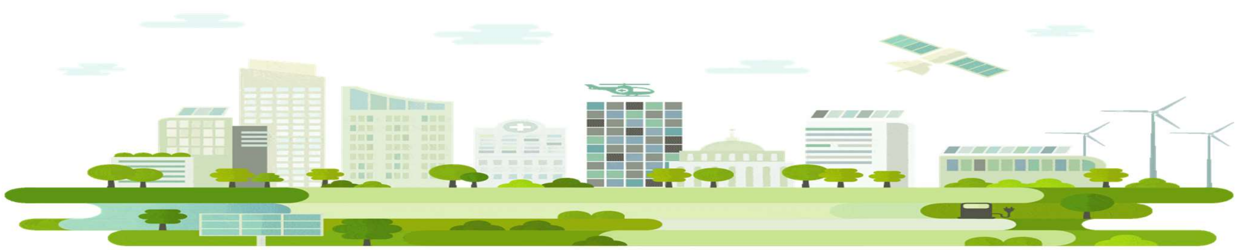
Shobhit University, Gangoh, Saharanpur (Accredited with NAAC 'A' Grade) has been notified by the Government of Uttar Pradesh vide Shobhit Vishwavidhaylaya, Uttar Pradesh Adhiniyam, 2011 (U.P. Act No.3 of 2012) passed by Uttar Pradesh Legislature and assented by the H.E. Governor of Uttar Pradesh. The University is established under section 2(f) of the University Grant Commission (UGC) Act, 1956. (Notification)

Shobhit University, Gangoh was established by the legislative bill of Uttar Pradesh Government vide Shobhit University Uttar Pradesh Act, 3 in 2012. It has since emerged as one of the very few universities that are rural-based in the sense they are deeply entrenched in the rural ambience of culture, environment, market and aspirations while technologically resting on the great shift on the continuum of Tradition and Modernity.

Today, the University has become a people's own institution, and offers programs that are based on local needs in the areas of Ayurveda, Engineering, Management, Pharmacy, Law, Education, Agriculture, Bio-technology, Bio-medical Engineering, Arts and Humanities, Naturopathy and Yoga, Paramedical Studies, and many other Short duration Skill Development Programs.

The University is proud of its alumni working on the national- international setting of professional excellence. "Empowering Nation through Education"- the University slogan- has not only stemmed the migration flow from the village to the city, but has also improved the socio-economic condition of the region.

The Shobhit University, Gangoh today presents not only its geographical rural character with immensely green surroundings, and pollution-free environment and simplicity of life, but also the rural-ness of its various courses and course additions. Youth and the population aspire for the University and the latter works for them in this sylvan part of North-western Uttar Pradesh where the villages see higher education face to face with open buds of swaying crops.



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About: STEM-Research Society

Est: 2020

DARPAN ID: UP/2025/0615045

The STEM-Research Society, a foundation is registered in the year 2020 to support and promote the research in the multidisciplinary domain under the able guidance of renowned academicians and researchers from India and abroad.

The objective of the foundation is Scientific, Technical, Research and Educational in nature. The foundation strives to advance the theory, practice, and application of Science, Technology, and Engineering & Management and maintains a high professional standing among its members. The basic purpose of the STEM-RS is to bring together Researchers, Academicians, Industrialists and Experts from different parts of the country and abroad to exchange the knowledge and ideas at a common platform by organizing National and International events such as Conferences, Seminars and Workshops that unite the Science, Technology, Engineering and Management and topics which are not mentioned here for the empowerment of research and development.

Vision

The STEM-RS foundation will build a dynamic, interactive, global community of researchers, academicians and industrialists to advance excellence in Science, Technology, Engineering and Management.

Mission

The STEM-RS is a foundation of interested peoples worldwide that promotes research for the advancement of society in various spheres and the quality of life.

Values

Being visionary, dynamic, interdisciplinary, inclusive, egalitarian and promoting research in all spheres of human life.

Diversity Statement

Diversity drives innovation. STEM-RS engage all demographic teams worldwide in advancing Science, Technology, Engineering and Management to improve the quality of life.

Please keep visiting the website for recent updates: https://stemrs.in/

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Message from the Organizing Team

It is our privilege and honour to welcome you all to the 4th International Conference on Recent Advances in Sustainable Environment (RAiSE 2025) organized at Shobhit University, Gangoh, Saharanpur (accredited with a NAAC 'A' grade) in technical collaboration with Dr B. R. Ambedkar National Institute of Technology Jalandhar, INDIA and supported by STEM-Research Society during December 5-6, 2025.

It is our great pleasure to present the souvenir/Book of abstracts with ISBN of the Fourth International Conference on Recent Advances in Sustainable Environment (RAiSE 2025).

We have received 125 research abstracts and after review 75 were accepted. These 75 papers were presented in different categories of 5 oral sessions with 4 invited talks. The theme of the RAiSE2025 is "*Environmental Sustainability*", that covered Healthcare, Soil conservation and Water; Food and Environmental Legislation; Renewable Energies; Waste and recycled materials, Civil infrastructure, and Environmental geotechnologies. Scientists, technologists, engineers, academicians and researchers from national laboratories, research centers, academic institutions, and industries from different parts of India and abroad are gathered on a common platform to interact with one another and shared their research activities in RAiSE-2025.

As the Organizing team of the conference, we extend our gratitude to the Advisory Committee, technical program committee, local organizing committee, potential reviewers, volunteers, and the staff members of the for their dedicated support.

We would like to thank all the authors, volunteers and persons who directly or indirectly contributed to the conference. Without their cooperation and full support, this conference would not have been possible.

We expect this conference will prove a memorable and productive discourse for all those who are a part of this event. I hope this event will motivate and profit everybody.

Organizers

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Dr. Vivek Kumar
Centre for Rural Development and Technology (CRDT)
Indian Institute of Technology Delhi
Delhi

Dr. Vivek, obtained his B.E. degree (1988-92) in Pulp & Paper Engineering, and M.E. degree (1992-94) in Chemical Engineering with specialization in Industrial Pollution Abatement. He completed his Ph.D. in 2000 (Thesis title: "Waste management for small scale Pulp & Paper Industry") from Indian Institute of Technology, Delhi. He was a Post Doctoral Fellow, IWT, Applied Science University, Wolfenbuttel, Germany from 2000-01. He has been involved in teaching and research in IIT Roorkee and IIT Delhi since 2004. He was a Visiting Research Professor, Department of Chemical Engineering & Applied Chemistry, University of Toronto, Toronto, Canada from 2014/6-2014/7. He has been the recipient of many awards and honors including SRF Grant awarded from Shastri Indo-Canadian Institute for a proposal entitled 'Novel Treatment Technology for High Salinity Water Using Membrane Distillation. He was elected International Director of Bio-Forest Product Division of American Institute of Chemical Engineers (AIChE) for three years from 2014-2017. Dr. Vivek has more than 18 years of research & development and academics experience on the development of low-cost technologies for the treatment of waste from medium and small industries. He has been involved in many research projects, mostly related to monitoring and treatment of industrial waste. He is a Project Investigator (PI) of the Indo-UK project entitled "Valorising Waste from Sugar Cane and Associated Industries via Innovations in Pre-treatment, Biotransformation and Process Intensification [vWa].

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Dr. Susheel Kalia
Ministry of Defence
Government of India, New Delhi

Dr. Susheel Kalia is an Associate Professor & Head in the Department of Chemistry at Army Cadet College Wing of Indian Military Academy Dehradun, India. He was awarded GOC-in-C Commendation Card by General Officer Commanding-in-Chief, Army Training Command, Shimla on 26 January 2018 for a positive approach, high level of motivation, outstanding qualities of leadership and sincerity towards the organization. He has been selected as a Visiting Professor at the Institute of Advanced Studies of the Alma Mater Studiorum University of Bologna, Italy for the year 2020-21. He was also visiting researcher in the Department of Civil, Chemical, Environmental and Materials Engineering at the University of Bologna, Italy in 2013 and held a position as Assistant Professor in the Department of Chemistry, Bahra University and Shoolini University, India until 2015. Kalia has around 82 research articles in international journals along with 13 books, 11 book chapters and around 7000 citations in his academic career. He has guided many MPhil. and Ph.D. students and delivered many invited talks at national and international conferences. His research interests include polymeric composites, bio- and nanocomposites, conducting polymers, nanofibers, nanoparticles, nanoferrites, hybrid materials and hydrogels. Kalia is an experienced book editor, and he has edited many successful books with Springer, Wiley and Elsevier. Kalia is the main editor of the "Springer Series on Polymer and Composite Materials", Springer International Publication, Switzerland and member of Editorial Board, International Journal of Plastics Technology, Springer India. In addition, he is a member of a number of professional organizations, including the Asian Polymer Association, American Chemical Society, Indian Cryogenics Council, the Society for Polymer Science, Indian Society of Analytical Scientists, and the International Association of Advanced Materials.

Dr. Swarnima Agnihotri
Swedish Centre for Resource Recovery
University of Borås, Sweden
Sweden

Dr. Agnihotri currently works as Senior lecturer at Swedish Centre for Resource Recovery, University of Borås, Sweden. She has completed PhD from IIT Roorkee, India. She received the postdoctoral fellowship for three years from Research Council of Norway and worked at Norwegian University of Science and Technology, Trondheim to enhance the biorefinery process development in Norway. As a scientist, her expertise is in the field of Industrial Biotechnology, Biorefinery and Resource Recovery.

Since 2015, she had worked at University of Borås in different research projects in Biotechnology group and teaching the course Biotechnology to undergraduate and Masters Students. She has supervised 6 Masters Specialization projects and currently supervising 4 PhD students. Focus of her research has been on pre-treatment processes of biomass for their valorization into several commercial products. She has also worked extensively on growing filamentous fungi on waste products, scaling up the process and their development into functional food and feed along with finding more interesting ways to valorize the biomass for a sustainable future. Currently she is working on to develop new climate smart proteins to be used in food and feed industry and to strengthen research and innovation collaboration by developing a test and demonstration environment in Europe. The project is funded by European Regional Development Fund (ERDF), Interreg IVB, North Sea Region Programme. She has around 15 publications in peer reviewed journals and has authored 3 book chapters. She is a reviewer for several international scientific journals such as Elsevier, Bioresource Technology, Bioengineered, Wood Chemistry and Technology, and BioResources. Her objective is to contribute to a sustainable future and a more conscious next generation through her research and teaching work.

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Dr. Viabhav Gupta
Sr. Technical Officer
IRDE, DRDO,
Ministry of Defense, GOI, Dehradun

Dr. Gupta, obtained his M.Sc. in Computer Science from MD University, Rohtak in 2002, M.Phil. Computer Science from Madurai Kamaraj University, Madurai in 2005 and P.hD. in Computer Science Engineering with Specialization in Neural Networks from Uttarakhand Technical University, Dehradun in 2021. DRDO He joined DRDO in 2002 at DRDO Delhi where he played lead role in major routing centre and developed intelligent mail server and routing tables. He joined DRDO premium electro-optical laboratory IRDE Dehradun in June 2005. He started his work in the area of automation and developed AI based algorithms for detection and tracking, Bad weather imaging, generative image reconstruction, passive ranging and super resolution for electro-optical systems. In 2016 he made significant achievement in the development of AI based battle tank detection system using artificial neural network approach for implementation of smart mines. During COVID Pandemic he has developed an intelligent system for fever detection from a safer distance using thermal imager among the crowd instantly for multiple persons. His important contributions includes development of automated VIPERS-HD for human detection during day/night conditions. Successful night trials were also conducted in Ladhak region at -25 celcius. In continuation to this VIPERS-AD (Anti Drone) has been developed with the capability to detect, track and classify miniature size flying object and UAV in the sky even in the pitch dark conditions using trajectory, acoustic and spatial models. As an eminent designer he has pushed himself beyond limits and achieved significant success in the development of AI based DRONE surveillance model to autonomously detect and classify various objects on the ground surface in the battle field region. He has also conceptualized a model for dropping of payload release mechanism using remote control operation or autonomously mounted on Drone. In his recent contributions he has also achieved facial recognition of humans from a substantial height through the optical sensor mounted on a flying Drone. The succesful trials were conducted at Uttrakhand Police Headquaters facility in Dehradun. He has been awarded patent for his contributions and published many research papers in the journals & conferences of high repute. He has been awarded DRDO Laboratory award for his outstanding contributions in the development of AI based systems in the year 2021.

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3	Buckling analysis of perforated plate	Aryan Yadav	JECRC university
5	Weaving Heritage, Sustaining Futures: A Study of Sikki Craft in Madhubani, Bihar	Rajesh Kumar* Md. Asjad Mokhtar	1. Department of Mechanical Engineering, Aryabhatta Knowledge University, Patna, Bihar - 800001 2. Department of Mechanical Engineering, Darbhanga College of Engineering, Darbhanga, Bihar - 846005
6	Towards a Meaningful Stakeholder Engagement with AI-driven Chatbots for Global Competitiveness	Ranbir Soram	Manipur University, Imphal
7	RULA Based Ergonomic Risk Assessment of Posture and Tool Use Practice Among Sikki Handicraft Artisans	Rajesh Kumar* Md. Asjad Mokhtar	1. Department of Mechanical Engineering, Aryabhatta Knowledge University, Patna, Bihar - 800001 2. Department of Mechanical Engineering, Darbhanga College of Engineering, Darbhanga, Bihar - 846005
8	The State of Artificial Intelligence: Now and Beyond	Ranbir Soram	Soram Ranbir Manipur University
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10	Anomaly-Resilient Control for Automatic Generation Control Systems: Detection and Mitigation of Data Integrity Attacks	Gudipati Jawahar Sagar Harshitha Puli Puli Tarun*	1. SRM AP, Havells India 2. SRM AP 3. NIT Andhra Pradesh

12	Transportation Electrification in Crisis: A 2025 Review of Electric Vehicle Mobility and Infrastructure Resilience During Disruptive Events	Gudipati Jawahar Sagar Puli Tarun Puli Harshitha*	1. SRM AP, Havells India 2. NIT Andhra Pradesh 3. SRM AP
13	The Impact of Changing Climatic Conditions in Ladakh on Water Security for High-Altitude Military Outposts: A Review of Current Systems and Future Strategies	Ganesh Kapahi* Dr. Abhishek Kumar)	NICE School of Business Studies, Shobhit Institute of Engineering and Technology, Meerut, India
14	Intelligent Control And Optimization Of Wireless Power Transfer Using Ai Techniques.	Navaneethakrishnan Packirisamy*	Sir Issac Newton College of Engineering and Technology Pappakovil-Nagapattinam
15	Mapping the Knowledge Landscape of Biogas Generation from Agricultural and Animal Waste	Akhileshawar Datt Sharma Ankit Sonthalia LAV KAUSHIK	1. Mechanical Engineering Department, Department of Technical Education, Uttar Pradesh 2. Gujarat Technological University - Institute of Technology and Research (GTU - ITR), Ahmedabad 3. Gujarat Technological University - Institute of Technology and Research (GTU - ITR), Ahmedabad
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27	Sugarcane Bagasse as Filler Material for Bioplastic and Biocomposite Preparation: A Review	Hritik Phuka* Ashraf Ali Debanil Das Satadru Kashyap Sushen Kirtania	Department of Mechanical Engineering, Tezpur University, Assam, India
28	Investigations on Hydrodynamics and Heat Transfer in a Riser System for Chalcopyrite-Based Waste Heat Recovery	Dr. Popuri Ashok Kumar* Dr. Pramod Kaki	Department of Chemical Engineering Vignan's Foundation for Science, Technology & Research Vadlamudi, Guntur Dist., Andhra Pradesh, India.
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30	Water Leakage Detection in the Pipes by using Sensor.	Rohit Sawant Sarthak Kamble Aarya Gulekar Om Vishwakarma Rachna Yadav	Pravin Rohidas Patil College of Engineering and Technology, Bhayandar, Thane
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33	Development and performance evaluation of sustainable hybrid composite bricks incorporating plastic waste, rubber threads & sand	Ashraf Ali* Ashif Zamal Ahmed Bhaskar Dhar Priyom Pratyush Gogoi Siddhant Dey Satadru Kashyap Sushen Kirtania	Department of Mechanical Engineering, Tezpur University, Napam, Tezpur, Assam, India
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48	Effect of organic and inorganic component in oil quality of mustard crop	Deepanshu saini* Shivani Shivani Savej Ali	Shobhit University gangoh
49	Effect of the organic and inorganic fertilizer on the quality of mustard oil	Deepanshu saini*	Shobhit University gangoh
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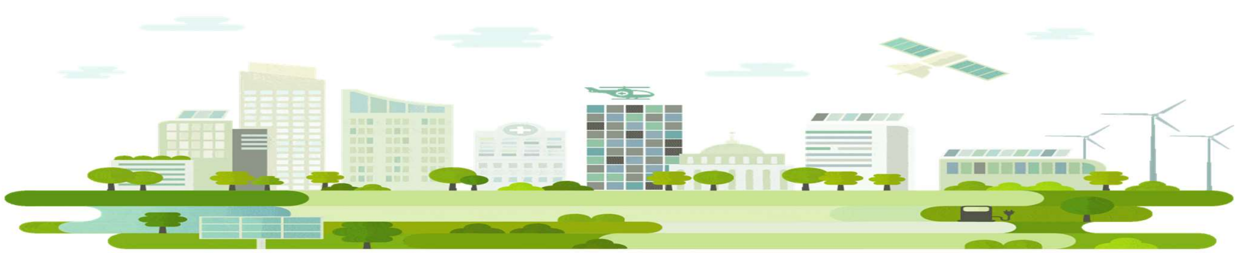

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3. Buckling analysis of perforated plate

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The drive towards sustainable engineering necessitates structures that are materially efficient, energy-conscious, and environmentally responsible. Perforated plates are a key technology in this pursuit, enabling significant lightweighting—a direct path to reducing material consumption and embodied carbon in aerospace, marine, and civil infrastructures. However, the introduction of perforations compromises structural stability, making buckling analysis critical for ensuring safety without negating sustainability gains. This literature review synthesizes research on the buckling behavior of perforated plates through the lens of sustainable design. It examines how analytical, experimental, and computational methods have been used to understand and optimize perforated plates for maximum efficiency. The discussion critically analyzes how parameters like cutout size, shape, and arrangement influence structural performance and, by extension, material usage. Furthermore, the review explores advanced topics such as the use of composite materials and AI-driven optimization, highlighting their role in creating next-generation, sustainably optimized structures. The conclusion affirms that mastering the buckling response of perforated plates is not just a structural mechanics challenge but a crucial contribution to sustainable engineering practices.

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5. Weaving Heritage, Sustaining Futures: A Study of Sikki Craft in Madhubani, Bihar

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"Sikki craft, an age-old grass-weaving cultural practice of Bihar's Mithila region, is a dynamic intersection of cultural heritage, women empowerment, and ecological sustainability. Remembering back to ancient times and carried forward by generations of Maithil women, sikki weaving converts golden-hued grass cut from marshlands into functional items, ritual objects, and today, modern lifestyle goods. This paper studies sikki craft in Madhubani, Bihar, as intangible cultural heritage and sustainable livelihoods. With field visits and surveys of artisans combined with secondary research and study of policy documents, the paper introduces into debate three interconnected dimensions. First, it follows the historical and ritual connotations of sikki craft, from its use in matrimonial rites and festivals like Sama-Chakeva, through to its symbolic import in folk tales of Raja Salhesh. Secondly, it investigates the socio-economic context of artisans, with new attention upon the gendered nature of craft work, reliance on income from household, and intergenerational skill transmission. Lastly, it considers existing challenges and opportunities, which ranges from declining demand and competition with synthetic alternatives, to act as facilitators. Even so, despite sikki artisans exhibiting strong ecological awareness and grounded practices into culture, their livelihoods are precarious. Market links are weak, there has been stagnation in design, and youth are disengaged. Manifold vulnerabilities exist; however, craft is highly viable and aligns with global understandings of cultural sustainability. By suggesting innovation paths this article places sikki craft as a living, adaptive practice that can sustain futures. Resurrecting heritage crafts such as sikki is a part of local livelihoods and the international effort towards sustainable cultural economies.

Keywords: Sikki Craft, Madhubani, Intangible Heritage, Women Artisans, Sustainability, Bihar, Traditional Knowledge"

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6. Towards a Meaningful Stakeholder Engagement with AI-driven Chatbots for Global Competitiveness

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Employees, investors, clients, and suppliers are a few examples of stakeholders that have a vested interest in the choices and operations of a company, group, or project. In order to manage an organization effectively and responsibly, stakeholder participation is especially important. However, it can be logistically difficult to involve a wide range of stakeholders, particularly in large-scale or multi-country development efforts. Chatbots have the potential to revolutionize this situation. With the help of advanced AI algorithms, chatbots can engage with stakeholders and offer ongoing support. By providing stakeholders with prompt, tailored responses, chatbots improve communication by cutting down on response times and increasing the effectiveness of information sharing. Nevertheless, implementing chatbots in any company is not without its difficulties. One of the most concerning aspects of chatbots is likely their capacity to disseminate inaccurate or misleading information. Unlike professionals who can cross-reference information and verify sources, chatbots mostly rely on their training data, which may contain biases, outdated knowledge, or apparent mistakes. This issue is exacerbated when presenting topics that require current information, such as current events or rapidly developing scientific disciplines. As chatbots become more common, data privacy concerns are growing. To work properly, these AI systems usually require access to massive amounts of data, raising worries about its storage, use, and security. A careful balance must be achieved between protecting personal information and leveraging data to help the company flourish. This article explores the development of an AI-powered chatbot and its application in stakeholder interaction in any professional organization to achieve long-term growth and meaningful outcomes for global competitiveness.

7. RULA Based Ergonomic Risk Assessment of Posture and Tool Use Practice Among Sikki Handicraft Artisans

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Sikki is a traditional craft practiced in the northern part of Bihar, prominently in the districts of Madhubani, Darbhanga, and Sitamarhi. It is mostly performed by female artisans who weave or cut-and-paste golden sikki grass into household and decorative items. A range of locally available and modified tools is used by artisans in the current time to make sikki products. Most of these tools are designed for other purposes and adapted to the requirements of the sikki craft process by the artisans. The craft is excessively labor-intensive, as it requires long hours of floor sitting, repetitive hand movements, and unusual postures, causing musculoskeletal disorders. The study identifies ergonomic risks in sikki craft activities based on the Rapid Upper Limb Assessment (RULA) approach. The methodology adopted includes field observations, surveys, and participatory interactions with artisans from Rampur, Jaynagar, and Raiyam clusters of Madhubani, and was supported by secondary research and documentation. Results show uniformly high RULA scores (6–8) in tool use practice and posture, indicating serious ergonomic risks. The takua, blade, BP handle, scissors, and thread cutter cause muscle strain in wrists and fingers. Wire handling and hasua usage are high-force activities with high injury potential. Long hours of sitting cross-legged on the floor cause (rated 7 RULA score) extreme ergonomic risk owing to trunk and neck flexion. All these conditions undermine artisans' health, productivity, and the sustainability of the craft. The research concludes that ergonomic tool redesign, changes in the workstation, and safer work practices, including micro-breaks, task rotation, and stretch routines, are necessary. Ergonomic tool and process design will help improve the occupational health of artisans, thus preserving the cultural legacy while promoting comfort, safety, and productivity.

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8. The State of Artificial Intelligence: Now and Beyond

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The field of computer science has made considerable strides in artificial intelligence in recent years. The number of Google searches for the phrase "Artificial Intelligence" by researchers and professionals increased significantly in 2022 and beyond. AI has rapidly transformed the way we interact with and utilize technology in our daily lives, from straightforward to complex problem-solving tasks. Recent breakthroughs and discoveries have sparked an incredible growth in and applications. From driverless cars to face recognition, artificial intelligence is being used in a wide range of fields these days. More and more, artificial intelligence is becoming a reality that permeates every aspect of our lives, not simply a trendy term. Virtual assistants on smartphones and driverless cars on the road are just two examples of how artificial intelligence has changed many aspects of our everyday lives. The definition of this process is the replication of human intelligence processes by computer systems using vast amounts of data. Although AI has great promise, it also poses a number of challenges and ethical dilemmas. Concerns about privacy, job displacement, and the impact of AI on society are growing more urgent as these technologies advance and become more sophisticated. This article provides a comprehensive overview of artificial intelligence's current state and future prospects while examining its advantages and drawbacks. The advantages and disadvantages of artificial intelligence technology as it is today are discussed below. Following that, we'll discuss emerging technologies and their potential social impacts as we consider AI's future. Finally, after examining the possibilities and difficulties of AI, we will talk about how to develop and apply it responsibly.

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9. Reinventing Ecology in Textile Manufacturing Practices: A Sustainable Livelihood Study in West Bengal

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The diversity of fibres and the intricate weaving traditions of India reflect the spirit, consciousness, and vibrancy of its indigenous textile heritage. In the era of digital interconnectedness, the effectiveness of sustainability on living and livelihood has emerged a key driver towards more inclusive and responsible future. Rethinking and restructuring the core of the textile sector for sustainable wellbeing now requires priority in the rapidly evolving global landscape. This study focuses on exploring the potential of indigenous textile manufacturing traditions in the state of West Bengal. The broader objective is to evaluate the livelihood patterns of the tribal population by examining textile craftsmanship and sustainability opportunities. The research design is exploratory, with data collected through non-probabilistic convenience sampling techniques. The multidimensional analysis includes aspects such as awareness, understanding, skill development, impact, continual training, satisfaction levels and government initiatives in the textile sector. The findings reveal that innovative and creative awareness demonstrate high reliability and internal consistency across various dimensions of the textile sector and their reciprocal effectiveness. The study also highlights a high level of satisfaction among rural populations towards textile occupations fostering sustainable livelihood avenues. The study showcases in harmonizing innovative dimensions of sustainable textile practices paving futuristic pathway for the Empathy, Ethics, Equity and Ecology in India's textile sector in the coming days.

Keywords: Textile, Manufacturing, Livelihood, Rural, Sustainability

10. Anomaly-Resilient Control for Automatic Generation Control Systems: Detection and Mitigation of Data Integrity Attacks

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The increasing reliance on cyber-physical infrastructure in modern power grids has exposed key components, such as Automatic Generation Control (AGC) systems, to sophisticated cyber threats particularly false data injection attacks that can compromise grid stability and economic operations.

While deep reinforcement learning (DRL) has emerged as a promising tool for adaptive, attack-resilient control, it often lacks robust mechanisms for actively detecting and mitigating deceptive inputs in real time. This paper proposes an enhanced DRL-based AGC controller integrated with a novel attack-resilient control framework that combines dynamic anomaly detection and adaptive control reconfiguration. The hybrid architecture enables proactive identification of integrity violations and real- time adjustments to control policies, safeguarding frequency regulation and system reliability during adversarial events. Sim-ulation results confirm that the framework preserves acceptable frequency bounds, minimizes disruption to market operations, and offers a substantial advancement over conventional defenses.

By synergizing intelligent learning with systemic resilience, this work charts a new path toward secure and stable smart grid control

12. Transportation Electrification in Crisis: A 2025 Review of Electric Vehicle Mobility and Infrastructure Resilience During Disruptive Events

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Transportation electrification continues to evolve as a cornerstone strategy in global climate action. However, the increasing integration of Electric Vehicles (EVs) into urban mobility systems introduces new vulnerabilities during disrup- tive events such as wildfires, floods, cyberattacks, and grid failures. This 2025 review critically evaluates the state-of-the- art advancements in EV mobility resilience, focusing on recent developments in charging infrastructure, disaster planning, and evacuation logistics. We extend previous findings by incorpo- rating insights from real-world disruptions (e.g., 2023–2024 climate-related events), advancements in vehicle-to-grid (V2G) technologies, and the emergence of artificial intelligence (AI)- driven evacuation planning. Particular emphasis is placed on the interplay between smart grids, decentralized charging networks, and adaptive routing during emergencies. The study identifies persistent gaps related to congestion management, mixed fleet behavior, and equity in access to emergency infrastructure. The findings aim to support policy development, infrastructure planning, and technological innovation that enhance the role of EVs as both mobility assets and energy resources during future disruptive events.

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13. The Impact of Changing Climatic Conditions in Ladakh on Water Security for High-Altitude Military Outposts: A Review of Current Systems and Future Strategies

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Climate change is having a pronounced impact on the strategically important super high-altitude areas (SHAA) of Ladakh, which are characterized by extreme altitudes exceeding 4,500 meters. The Indian Army operates important military outposts in these treacherous and inhospitable regions, where troops are deployed throughout the year. Changing climatic conditions in Ladakh, such as rising temperatures, changed precipitation patterns, and rapidly retreating glaciers, are threatening the long-term sustainability of natural water resources in the region. The Army's forward military posts, which were traditionally dependent on glacial water and seasonal snowmelt, are facing a significant water crisis. This environmental challenge is posing a threat to the operational readiness, health, and morale of troops, for whom a consistent water supply is essential for survival and mission accomplishment. This paper studies the impact of changing climatic conditions in Ladakh on the water security of military outposts deployed in the high-altitude areas of Ladakh. The paper examines the present system of water procurement and management for high-altitude outposts, which depends on logistically intensive methods such as ferrying water through porters and ponies. These methods are not only costly and hazardous but are also unreliable in the face of climate instability. The study identifies the limitations in the current water management infrastructure and practices in light of the impact due to climate change. In response to these challenges, the paper recommends a comprehensive way forward, focusing on alternate methods and new technologies, including the use of artificial glaciers, rooftop rainwater harvesting, and storage of winter snow. The integration of new technologies along with improved water conservation practices and climate-adaptive planning can help to address water security and maintain the operational capability of military outposts in this important region.

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14. Intelligent Control and Optimization of Wireless Power Transfer Using Ai Techniques

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Wireless Power Transfer (WPT) is an emerging technology that makes contactless energy transfer possible for uses spanning from consumer products to electric vehicles and implantable medical devices. Yet, its real-world application suffers from limitations like efficiency reduction, sensitivity towards misalignment, load fluctuation, and time-varying environmental conditions. These shortcomings are overcome by integrating Artificial Intelligence (AI) methods into WPT systems to meet adaptive, resilient, and smart control needs. This paper discusses a detailed investigation of AI-facilitated optimization techniques of WPT, using machine learning and deep learning frameworks predicting coupling conditions, resonance frequency optimization, and real-time power flow regulation. Reinforcement learning-based algorithms are considered for adaptive impedance matching, with neural networks being used for non-linear system modeling and predictive performance optimization. Simulation and experimental results show that AI-based WPT systems exhibit substantial improvements in system stability, transfer efficiency, and adaptability over traditional methods. The fusion of AI and WPT holds the key to designing self-optimizing, high-efficiency, and scalable wireless energy infrastructures toward the realization of a smart and sustainable wireless society.

15. Mapping the Knowledge Landscape of Biogas Generation from Agricultural and Animal Waste

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This study illustrates systematic bibliometric analysis of quality publications the Scopus indexed database from 2014 to 2024, focusing on the conversion of animal and crop residues into biogas. Analyzing 2,001 articles, we observe a significant increase in publication rates, from 2.09% in 2014 to 19.8% in 2023, followed by a 9% decline in 2024, indicating a nascent literature emergence. The research predominantly falls within the categories of Environmental Science, Energy, Engineering, Agricultural and Biological Sciences, and Social Sciences, with major contributions from journals such as Energies (9.80%), Sustainability (5.80%), and Bioresource Technology (3.15%). Geographically, China leads with 322 publications, followed by the USA (201), UK (169), Italy (168), and Spain (152), highlighting significant research activity. Key themes include anaerobic digestion, biogas, methane, and biomass, with influential contributions from organizations like the University of Seville and the University of carthage. Notable authors like Smith J. and Cucchiella f. exemplify impactful leadership in this field. Rising attention toward biochar, biomethane, advanced biogas utilization, and circular economy frameworks signal new avenues for exploration. The synergizing localized renewable sources and energy optimization techniques aligns with Sustainable Development Goals (SDGs), emphasizing the need for supportive policy interventions. This analysis elucidates trends, interdisciplinary connections, and policy implications, providing valuable insights for the 'Animal and Crop Residue to Biogas' research community while forecasting critical research priorities.

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16. Sustainable Development of Bioplastics and Natural Fiber-Reinforced Bio composites Using Mango Seed Starch: Current Trends and Future Prospects

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Composite materials combine two or more substances so that the resulting structure performs better than its individual parts. In these materials, a matrix holds the reinforcing fibers together, giving the product improved strength and durability. Due to their advanced properties, they find applications in a wide range of fields. However, once they reach the end of their life cycle, their disposal becomes difficult. Furthermore, on being burnt they causes air pollution. Similarly, the increasing environmental damage caused by the overuse of petroleum based plastics has created a demand for alternative sustainable materials. Bioplastics and bio composites made from natural resources are emerging as eco friendly solutions due to their biodegradability and low cost. Mango seeds obtained from mango (Mangifera indica) is an agricultural waste with high starch content and good film forming properties. This makes it a promising matrix material for bioplastics. Addition of natural fibers such as banana fiber, jute, coir, etc. further improves mechanical properties of the resultant bio composites. This approach is in line with Sustainable Development Goal 12: Responsible Consumption and Production, and Goal 13: Climate Action, by reducing waste and supporting green materials. This review summarizes the extraction methods, material properties, processing techniques, applications, benefits, and challenges of using mango seed starch and natural fibers in bioplastics and bio composites, showing their potential to support a circular economy.

17. Jute Fiber Reinforced Composites: A Sustainable Alternative for Automotive and Packaging Industries

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The growing demand for sustainable materials and the depletion of petroleum-based resources have driven interest in renewable, biodegradable alternatives to synthetic composites. Natural fiber–reinforced polymer composites (NFRPCs) offer low cost, light weight, recyclability, and adequate performance for diverse applications. Among natural fibers, jute is particularly attractive due to its abundance in South Asia, high cellulose content, strength-to-weight ratio, and biodegradability. This review outlines the journey of jute composites from raw fiber extraction and surface treatment to processing, property evaluation, and industrial applications. Emphasis is placed on mechanical, thermal, and morphological properties, along with strategies to address major challenges such as moisture uptake, fiber quality variability, and poor fiber–matrix adhesion. Industrial case studies demonstrate successful integration of jute composites in European automobile components and sustainable packaging solutions. A comparative analysis of jute fibers and jute/epoxy composites is provided to highlight their engineering potential. Finally, the future prospects of jute composites are discussed in the framework of circular economy, green technologies, and growing policy support for eco-friendly materials. Overall, this review underscores the potential of jute composites as sustainable, high-performance, and commercially viable alternatives to synthetic counterparts.

Keywords: Jute fiber, natural composites, automobile, packaging, sustainable materials

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18. Investigation of Mechanical loads developed on Diesel Engine Piston using La2Ce2O7 Ceramic Coating

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Piston is one of the most important components of an engine. It facilitates the conversion of heat energy into useful mechanical work through its to and fro motion. This study focuses on the investigation of the mechanical behavior and operational performance of a diesel engine piston using ANSYS simulation software. Diesel engine pistons are subjected to intense thermal and mechanical loads, necessitating a detailed understanding of their structural response under varying conditions. The actual material properties of the piston were experimentally determined and used as the basis for finite element analysis. A 3D model of the piston was created using a 3D scanner to ensure geometric accuracy. The analysis was performed by applying internal combustion pressure as the loading condition, with fixed and frictionless supports as boundary conditions. The study compares the performance of the base piston material with that of a Lanthanum Cerate (La2Ce2O7) ceramic-coated piston to evaluate material sustainability and enhancement in mechanical properties. Key parameters analyzed include equivalent stress, equivalent strain, and fatigue damage, with particular emphasis on fatigue behavior due to its significance in piston failure under cyclic loading. The comparative results highlight the effectiveness of ceramic coatings in enhancing durability and thermal resistance. Additionally, the environmental and performance sustainability of the best performing material is discussed, providing insights into its viability for long-term engine applications.

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19. Antibacterial assay of methanolic plant extracts and copper nanoparticles

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Nanoparticles are ultra-small particles ranging in size from 1 to 100 nanometers. Due to their small size, they often exhibit different properties from bulk materials, owing to their high surface area and quantum effects. These engineered particles have revolutionized fields such as medicine, electronics, energy, and textiles. Raw materials for nanoparticle production are multifold, ranging from Synthetic to natural materials. The present study investigates the use of methanolic leaf extracts from five plants, including Psidium guajava, Moringa oleifera, Annona squamosa, Vitex negundo, and Citrus limon, for the synthesis of copper nanoparticles (CuNP). Phytonutrients present in the dried leaves were extracted through the Soxhlet apparatus and tested for antibacterial activity. The ZOI of antibacterial activity against Escherichia coli of the methanolic extracts is guava>vitex>custard apple>lemon>moringa, while the ZOI against Staphylococcus aureus is vitex>guava>custard apple. These methanolic extracts were used in combination with sericin extracted from Bombyx mori silkworm cocoons in 1:2 ratio to make CuNPs. Three processes were attempted to synthesize CuNP's namely aqueous method, polyol method and irradiation in a microwave. All the CuNPs synthesized were characterized and an antibacterial assay was carried out. The results indicate that the efficacy of the antibacterial finish was in the order of irradiated CuNP>polyol method CuNP>aqueous CuNP>methanolic leaf extracts. The same order was also true in terms of the time taken for the synthesis of CuNP. The study established that irradiation technique was very fast, simple and easy method to produce CuNP as the high temperature enabled the faster breakdown of the chemicals into nano form, with the end product exhibiting better antibacterial activity.

20. Upcycling – Value Addition to Apparels

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Today in the era of increasing environmental concerns Apparel and textiles are also moving towards sustainable concepts. Upcycling of used apparels and textiles has become a game-changing strategy in the fashion sector. This article discusses the ideas of upcycling in terms of value addition to clothing and emphasizes how the textile waste can be reduced, also explores to extend the life span of products and support innovative reuse. Upcycling, is completely opposite to recycling, as in this process textiles/ apparel will be given more value without disassembling them into their component parts. The study examines various upcycling methods and their potential applications in enhancing the functional and aesthetical value of the product. To improve the aesthetic value, products can be upcycled with use of many simple techniques like reconstruction or surface embellishment with painting, patchwork, embroidery and printing. Furthermore, it also highlights the socioeconomic benefits of upcycling, including prospects for designers, small-scale artisans, crafts people and sustainable fashion entrepreneurs. The paper concludes that upcycling encourages innovation and financial expansion in the fashion sector in addition to promoting environmental sustainability.

Keywords: Upcycling, Sustainable fashion, Value addition, Environmental impact

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22. Fluorescein-Based Colorimetric and Fluorimetric Turn-On Chemosensors: Empirical Studies and Real-World Applications

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A fluorescent chemosensor based on fluorescein derivative was devised, synthesized, and tested as a selective Hg^{2+} ion sensor. The structure was characterized by spectroscopic methods. Primarily, the chemosensor's colorimetric detection and fluorescence alterations are exceptionally specific for Hg^{2+} ions in the presence of other metal ions, fulfilling the necessary selection criteria for real-world use. In the presence of a significant excess of competing metal ions (Ag^{+}, Al^{3+}, Ba^{2+}, Cd^{2+}, Ce^{3+}, Co^{2+}, Cr^{3+}, Cu^{2+}, Hg^{2+}, Mg^{2+}, Mn^{2+}, Ni^{2+}, Sr^{2+}, Zn^{2+}, Fe^{3+}, Fe^{2+}) the probe exclusively binds with Hg^{2+} ions and shows discernible alterations in its absorbance and fluorescence spectrum conduct. These spectral alterations are allowed for naked eye detection because they are notable in the visible portion of the spectrum. According to comprehensive experimental and theoretical results, the addition of Hg^{2+} ions to the FHV solution contributes to the generation of a two-fluorescence peak at visible and NIR region. Moreover, Job's plot, Fluorescence titrations and DFT theoretical calculations corroborated the 1:1 stoichiometric structure between FHV and Hg^{2+} ions. With its excellent sensitivity (18 nM) and selectivity at nanomolar concentrations, the suggested sensing device can be effectively used to detect Hg^{2+} in wastewater samples exhibiting a turn-on fluorescence response.

23. Degradation of Rhodamine B dye using biochar and synthesized ZnO/biochar photocatalysts to study the synergistic effect of photocatalysis and adsorption

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Biochar derived from bio wastes are used as an effective adsorbent. However, modification of the carbon based material biochar to use it, as an effective photocatalyst in visible light remains a challenge. This study presents the oxidation of pyrolyzed polanga seeds biochar by dispersing the biochar in HNO3 through sonication process. The oxidized biochar was used for synthesis of ZnO/biochar photocatalyst (1:10 w/w) by co-precpitation method. Several characterization techniques XRD, FTIR, BET, SEM-EDS, UV-DRS and Raman spectroscopy were performed to test the properties of ZnO/PSB photocatalyst. The ZnO/biochar photocatalyst showed enhancement in the specific surface area (234.2 m2/g) due to oxidation of biochar. The reduction in the band gap energy was found out from tauc plot. The parametric studies were performed to find out the optimal conditions (pH =2, photocatalyst dosage 1.2 g/L, contact time of 40 minutes, and 8 mg/L initial concentration of dye). The photocatalytic reaction followed 1st order kinetics. NaOH (0.1 N) was used for desorption study of Rhodamine b dye (99.2 %) from the ZnO/biochar photocatalyst. The regeneration study confirmed that the photocatalyst can be reused upto 3 cycles without effecting the degradation percentage much. Based on the results, photocatalysis showed more degradation % than adsorption.

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24. Genetic and Cellular Engineering: Advancing Therapeutics, Biofuels, and Synthetic Biology

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Genetic and cellular engineering represent core disciplines of modern bio-engineering, enabling precise manipulation of genes and cells to create innovative biological systems. Recent advances, including CRISPR-Cas genome editing, synthetic biology, and cell reprogramming, have transformed approaches to disease treatment, biofuel production, and biomanufacturing. Engineered cells now serve as therapeutic agents, biosensors, and versatile platforms for biotechnological innovation, bridging molecular biology with engineering design. This review highlights key developments in genetic and cellular engineering, focusing on their biomedical and industrial applications. It also addresses ethical, safety, and regulatory challenges associated with manipulating living systems. The integration of computational modeling, systems biology, and artificial intelligence is fostering the development of environmentally responsible, resource-efficient, and sustainable bioengineering solutions that align with global sustainable development goals.

25. A Comprehensive Overview of Smart On-Road Innovations and Their Impacts on Road Safety

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The transportation industry is changing due to the quick development of smart on-road technologies, which provide creative ways to increase traffic efficiency and road safety. The results of numerous (more than 50) research papers, industry reports, and regulatory frameworks are compiled in this meta-overview to investigate how smart technologies might improve traffic flow, lower the number of traffic accidents, and support connected and autonomous vehicle systems. Intelligent Transportation Systems (ITS), Vehicle-to-Everything (V2X) connectivity, Advanced Driver Assistance Systems (ADAS), intelligent traffic signals, and real-time data analytics driven by the Internet of Things (IoT) and artificial intelligence (AI) are some of the key technologies examined.

The review highlights the significant impact these technologies have had in decreasing human error-the leading cause of traffic incidents-and fostering proactive hazard detection and mitigation strategies. Furthermore, the study explores how data-driven decision-making, enabled by integrated sensors and cloud connectivity, contributes to dynamic traffic management and predictive safety interventions. However, the overview also addresses critical challenges such as cyber security risks, high infrastructure costs, data privacy concerns, and the need for standardized regulations across jurisdictions. The integration of smart technologies into road networks and vehicles presents both immense opportunities and complex policy and technical considerations. By consolidating modern information and identifying research gaps, this meta-overview provides an inclusive perceptive of how smart on-road technologies can be leveraged to develop transportation systems that are safer, more intelligent, and more sustainable. The findings of this research serve as a foundation for governmental official, policymakers, engineers, urban planners, and researchers working toward the goal of zero road fatalities in the era.

26. Availability Analysis of Solar Plant Subject to Repair Facility

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Solar plants are used to generate the electricity by converting sunlight into electrical energy using photovoltaic panels. For the regular supply of electricity, the solar panels, inverter system, transformer, stabilizer, and monitoring system are required. If any component fails then whole system failed. All failure rate and repair rate follow general distribution. Semi-markov process and regenerative point graphical technique are used to analyse the availability of the solar system.

Keywords: Availability, photovoltaic panels, semi-markov process, solar plant, RPGT.

27. Sugarcane Bagasse as Filler Material for Bioplastic and Biocomposite Preparation: A Review

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Abstract: Sugarcane bagasse (SCB), an abundant agro-industrial by-product, has gained significant attention as a low-cost filler material for bioplastics and biocomposites. Incorporation of SCB into polymer matrices enhances mechanical, thermal, and barrier properties while promoting biodegradability and sustainability. This review provides a comprehensive overview of SCB composition, extraction and processing methods, preparation of bioplastics/biocomposites, characterization techniques, and applications. Additionally, challenges and future research directions for optimizing SCB-based biopolymers are discussed. Typical data on mechanical and thermal properties from literature are summarized to aid researchers in material selection. Figures and schematics are included to illustrate fiber structure, composite fabrication processes, and application examples.

Keywords: Sugarcane bagasse, bioplastics, biocomposites, filler, biodegradability, mechanical properties

28. Investigations on Hydrodynamics and Heat Transfer in a Riser System for Chalcopyrite-Based Waste Heat Recovery

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Energy, a critical input, is to be efficiently managed via waste heat recovery and energy reuse for the economic viability of a process industry. In particular, cement manufacture demands a huge quantum of energy, for the necessary reactions. Huge amounts of hot effluent gases are generated. Energy recovery from these waste gases is an area that is of contemporary research interest. Now, about 75% of total heat recovery takes place in the riser of the suspension pre-heater system. This article deals with the hydrodynamic and heat transfer aspects of riser typically used in the cement industry. An experimental apparatus was designed and fabricated with provision for the measurement of gas pressure and solid temperatures at different heights of the riser. The system studied was air - chalcopyrite taken in different particle sizes. Acceleration length (LA) determined at different parametric levels was fitted to an empirical correlation. An empirical model was developed for Nusselt number as a function of Reynolds and Prandtl numbers using regression analysis.

29. Effect of Web Opening Shape on shear strength of Reinforced Concrete Deep Beams

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In reinforced concrete deep beams, web openings are essential for utility services, including electrical conduits and air conditioning ducts. However, these openings reduce the ultimate strength of beam by decreasing the concrete mass. This study employs finite element analysis utilizing ANSYS to examine RC deep beams with web openings until failure. Research focuses on deep beams with different shaped web openings. The findings suggest that beams with circular openings have better shear capacity and may be preferred compared to rectangular and square openings.

30. Water Leakage Detection in the Pipes by using Sensor.

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Hidden leaks in networks of pressurized pipes are a major global issue that can cause a lot of clean water to be wasted, result in high costs, and potentially damage important infrastructure. In this study, a smart, real-time method is introduced for accurately finding and detecting leaks in pipelines without needing to dig up the pipes. This method uses a combination of sensor technologies.
The system includes a network of highly sensitive acoustic sensors and devices that monitor changes in pressure. These are placed carefully throughout the pipeline network. To distinguish leak signals from normal flow changes and other background noises, raw data is processed with advanced signal analysis techniques, especially the Wavelet Transform. The unique patterns created by leaks are then examined using a machine learning model that helps identify the leak and pinpoint its exact location through a process called triangulation or correlation. The results show that this system can detect leaks with over 95% accuracy and can locate them with an average error of less than one meter. This method is strong, easy to scale, and very cost-efficient. It improves the way pipelines are managed proactively and helps protect water resources while making operations more efficient.

31. Recent Advances in Renewable and Clean Energy Systems

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The global energy sector is undergoing a transformative shift driven by the urgent need to mitigate climate change and ensure sustainable energy access. Renewable and clean energy systems—including solar, wind, hydro, and emerging technologies such as green hydrogen—are at the forefront of this transition. This paper provides an exhaustive review of recent advances (2022–2025) in renewable energy generation, energy storage, and system integration, with a focus on technological innovation, deployment trends, and policy frameworks. Methodologies for assessing efficiency, economic feasibility, and environmental impacts are examined, alongside an evaluation of barriers, risks, and research gaps. This comprehensive analysis highlights actionable strategies for accelerating adoption and integrating renewable energy systems into global energy infrastructures.

32. Machine Learning Strategies for Optimal Control in Quantum Otto Engine

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The behavior of quantum heat engines is fundamentally constrained by the balance between efficiency and power under finite-time conditions, with shortcut-to-adiabaticity (STA) protocols introducing additional energy costs. In this paper, we utilize Machine Learning (ML) optimization to enhance the behavior efficiency of the quantum Otto engine. A neural network is used to represent the time-dependent driving frequency $\omega(t)$, enabling systematic exploration of optimal control protocols beyond standard polynomial ansatz schemes. Our results demonstrate that ML-optimized protocols achieve consistently higher efficiency and efficient power, reduced the cost in finite time. At short cycle times, ML strategies suppress non-adiabatic excitation more effectively, while in the quasi static limit both methods converge to the Carnot bound. These findings highlight the potential of ML-based control strategies for simultaneously balancing efficiency, power, and energetic cost in quantum thermal machines.

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33. Development and performance evaluation of sustainable hybrid composite bricks incorporating plastic waste, rubber threads & sand

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Abstract:

This study investigates the development of hybrid composite bricks using low-density polyethylene (LDPE) plastic waste, sand, scrap rubber threads, and cement as potential sustainable alternatives to conventional clay bricks. The motivation is to address environmental challenges caused by plastic and rubber waste while providing durable and cost-effective building materials. Bricks of different compositions were fabricated and tested for compressive strength, water absorption, hardness, and bond strength. Results revealed compressive strength ranging from 7.16 N/mm^2 to 14.53 N/mm^2, with the LSC sample achieving the highest value, surpassing traditional clay bricks (3.5–10 N/mm^2). Water absorption was significantly lower than clay bricks, indicating improved durability. Hardness tests showed values between 41.5 HDD and 55.16 HDD, with some samples exceeding the average hardness of conventional bricks. Bond strength values ranged from 0.0097 N/mm^2 to 0.0266 N/mm^2, below conventional bricks (0.080 N/mm^2). ANSYS simulations validated the structural performance of the hybrid bricks under loading. Overall, the results demonstrate the feasibility of hybrid composite bricks for sustainable construction, by reusing waste plastics and rubbers.

Keywords: Hybrid composite brick, plastic waste, rubber reinforcement, sustainable construction, compressive strength

34. Integration of Immobilized Bacterial Cells (Bacillus xiamensis and Pseudomonas stutzeri) and Phytobed Technology for Sustainable Wastewater Treatment

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Wastewater treatment is a critical process for maintaining environmental health and sustainability. In recent years, there has been growing interest in integrating innovative technologies to enhance treatment efficiency while minimizing environmental impacts. This study aims to investigate the efficacy of individual bacterium, consortium, phytoremediation and integration of both technologies in phytobed system to remediate industrial wastewater. Indigenous bacteria isolated from Common Effluent Treatment Plant waste sludge were explored for Industrial Wastewater treatment through pour plating culture approach followed by screening, identification and their characterization used for pollutants removal investigation. After 96 hours of Hydraulic Retention Time (HRT) the experiment was able to reduce the Electrical conductivity by 63.45%, TDS by 63%, COD by 87.83%, BOD by 86.2%, Nitrate nitrogen by 90.4 %, Phosphate by 90.1%, Iron (Fe) by 97.17%, Manganese (Mn) by 92.69% and Nickel (Ni) by 91.80% as compared to their initial value. The chlorophyll content of the plants was analyzed and was seen to be reduced after the experiment.

35. Somaclonal Variation: A Sustainable Approach for the Development of Salt and Drought Tolerant Stevia

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Sustainability in modern agriculture demands the development of crop varieties resilient to abiotic stresses such as salinity and drought. Stevia rebaudiana Bertoni, a natural source of low-calorie sweeteners, is valued for its health and commercial benefits but is still sensitive to environmental stress conditions. The present study focuses on utilising somaclonal variation, an in vitro–induced genetic variability arising during tissue culture, as a potential approach to enhance salt and drought tolerance in Stevia. Findings will highlight the potential of tissue culture–mediated somaclonal variation as a sustainable strategy for developing stress-tolerant stevia cultivars, thereby contributing to crop improvement and resilience under changing climatic conditions.

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36. Sustainable Enhancement of Jute-Epoxy Composites with Nanoclay Reinforcement for Improved Mechanical and Thermal Performance

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In recent years, there has been a notable escalation in the demand for sustainable and environmentally benign composite materials, driven by heightened environmental consciousness and the exhaustion of petroleum-derived resources. The integration of natural fibers, such as jute, with sophisticated fillers like nanoclay presents a promising avenue for the development of high-performance green composites. This research examines the effects of nanoclay filler on the mechanical and thermal characteristics of jute-epoxy composites. Composite specimens comprising 20% jute fiber along with varying percentages of nanoclay (3–12 wt%) were synthesized and subjected to testing. The composites were evaluated for their tensile, flexural, hardness, impact, and hygrothermal properties. The results indicated substantial enhancements in tensile and flexural strength at a nanoclay content of 7 wt%, beyond which there was a deterioration in mechanical performance. Hardness exhibited a consistent increase in relation to filler content, whereas impact strength reached its maximum at moderate levels of nanoclay incorporation. Hygrothermal analysis demonstrated a decrease in moisture absorption as nanoclay content increased. The results imply that 7 wt% nanoclay offers an optimal equilibrium of mechanical and environmental resistance properties, thereby positioning these composites as viable candidates for utilization in the automotive, maritime, and construction industries.

Keywords: Jute fiber; Epoxy composites; Nanoclay filler; Mechanical properties; Thermal stability; Sustainable materials.

37. Assessment of Land Use/Land Cover Patterns and Their Impact on Mangrove Ecosystem Health in the Gulf of Kachchh, India

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Mangroves are one of the ecologically and economically important ecosystems for society and the environment. However, they became threatened worldwide owing to deforestation, urbanization, industrial development, and aquaculture activities. In the present study, remote sensing and GIS techniques were applied to assess the health status of the mangrove ecosystem in the Gulf of Kachchh. A Land Use/Land Cover (LULC) and Normalized Difference Vegetation Index (NDVI) analysis was carried out to elucidate the spatial land use patterns and assess the mangrove health status. A total of 8 LULC classes has been classified, including built-up land, mudflat, saltpan/aquaculture, saline soil, water, road, and other. Mudflats represent the second-largest LULC category; however, their area has been steadily decreasing over the past decades, converting into saltpans and mangroves. Saltpans, the third-largest land-use class, showed an increasing trend compared to previous studies. The region's extensive salt production and brine disposal likely contribute to elevated water salinity observed in this study, while mangrove cover has also increased relative to earlier findings. Built-up land has increased compared to previous studies. NDVI analysis indicates that 60% of the mangrove cover is in very poor health, 29% in poor health, 8% in moderate condition, and only 3% falls under the healthy category. The findings of this study enhance the understanding of mangrove ecosystems and can support the development of effective management and conservation strategies for tropical mangrove regions.

Keywords: Land Use/Land Cover (LULC), Normalized Difference Vegetation Index (NDVI), Mangroves, Gulf of Kachchh

38. Rice Husk Biochar: A Green Solution for Soil Health Improvement and Carbon Sequestration

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Abstract:
Rice husk, a major agricultural byproduct of rice milling, represents an abundant and underutilized biomass resource. Converting rice husk into biochar through pyrolysis offers an effective and sustainable method for waste valorisation and environmental management. Pyrolysis is a thermochemical process carried out in the absence or limited presence of oxygen, where organic materials decompose to form biochar, bio-oil, and syngas. Among these, biochar is a stable carbon-rich product with wide applications in soil improvement, pollution control, and carbon sequestration. The production efficiency and quality of rice husk biochar depend on several parameters such as pyrolysis temperature, heating rate, residence time, and reactor type. Generally, slow pyrolysis at temperatures between 350°C to 600°C yields biochar with high carbon content and stable structure. Rice husk biochar exhibits a porous surface, high silica content, and good cation exchange capacity, making it useful for improving soil fertility, water retention, and reducing heavy metal contamination. Additionally, the use of rice husk biochar contributes to reducing greenhouse gas emissions and promoting circular bioeconomy principles by transforming waste into value-added material. Recent studies highlight its potential in carbon capture, wastewater treatment, and microbial activity enhancement in soils. Thus, pyrolyzing rice husk not only addresses agricultural residue management challenges but also supports sustainable development goals (12) by offering eco-friendly and economically viable solutions. This paper discusses the pyrolysis process parameters, properties, and multifaceted applications of rice husk biochar, emphasizing its role in sustainable agriculture and environmental protection.

Keywords: Rice husk, Pyrolysis, Biochar, Waste valorisation, Sustainable agriculture, Carbon sequestration.

39. OUR LAND, OUR RIGHT: STOPPING POLLUTION BEFORE IT STARTS

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Everything that surrounds us, whether living and non-living, is considered to be part of the environment. Humans, animals, and plants are all considered living creatures. Life on Earth depends on non-living elements including sunshine, soil, water, and air. However, there are now significant environmental issues as a result of human negligence, urbanization, and fast industrialization. These include contamination of the air, water, and land; deforestation; biodiversity loss; climate change; global warming; overpopulation; poor waste management; and an accumulation of plastic. Several conservation initiatives have been adopted on a national and international scale to address these growing issues. The Environmental Impact Assessment, or EIA, is one of the most vital tools in environmental management. The Environmental Impact Assessment (EIA) is an elaborate process used to forecast and assess the environmental impacts of planned development projects prior to their start. By comparing many project possibilities, it assists in selecting the one that provides the optimum balance between environmental sustainability and economic growth. The EIA, which was first implemented as a revolutionary environmental law in the 20th century, has been essential in mitigating environmental damage before it happens. Environmental regulations, monitoring programs, and human rights principles all contribute to the EIA's effectiveness. These guarantee openness, public participation, and the welfare of the community. As a fundamental human right, safeguarding the environment enables individuals to demand accountability and protect natural resources.

Keywords:
Environmental Impact Assessment (EIA), Human Rights, Sustainable development, Environmental Protection, Public Participation, Environmental Governance

40. Antibacterial Study of Silver and Copper Nanoparticles Synthesized from extract of Elaeocarpus

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Abstract:
The development of eco-friendly nanomaterials plays a vital role in achieving sustainable technological solutions. In this study, Silver (Ag) and Copper (Cu) nanoparticles were synthesized using leaf and bark extracts of the Elaeocarpus through a green synthesis approach. The natural compounds in the plant extracts work as reducing and stabilizing agents, avoiding the use of toxic chemicals. Silver nanoparticles showed clear optical and structural features, while copper nanoparticles displayed more varied shapes and a tendency to cluster. Both types of nanoparticles were analyzed using UV–Vis, X-ray diffraction and electron microscopy revealed that Ag nanoparticles were mostly spherical and well-dispersed, whereas Cu nanoparticles exhibited variable morphologies and higher aggregation. FTIR analysis confirmed the presence of phenolic and hydroxyl groups. Silver nanoparticles showed stronger antibacterial and antioxidant activities at lower doses, while copper nanoparticles also showed good activity but needed higher concentrations. This green synthesis approach supports sustainable development by using renewable plant materials, reducing chemical waste, and lowering energy use.

Keywords: Nanoparticles, Elaeocarpus, X-ray diffraction, FTIR.

41. Hairy Root production in Elaecarpus ganitrus under submerged conditions

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Elaeocarpus ganitrus, generally known as Rudraksha, is a medicinally revered tree species known for its bioactive phytochemicals & therapeutic compounds. This study focuses on the induction of hairy root cultures in E. ganitrus using Agrobacterium rhizogenes-mediated transformation, followed by cultivation under submerged conditions. For the production, young healthy leaves of E. ganitrus are taken as explant followed by surface sterilization using tween-20, ethanol and mercuric chloride to prevent contamination. Leaf explants were infected with A. rhizogenes strain under sterile conditions, resulting in the successful emergence of hairy roots characterized by rapid growth, lateral branching, and hormone-independent proliferation. Fast growing, hairy roots emerging from the infection site are selected and maintained in submerged cultures, with regular sub-culturing to promote vigorous growth. The study demonstrates the potential of hairy root cultures as a scalable and sustainable platform for producing pharmacologically important compounds from E. ganitrus, offering an alternative to conventional harvesting and aligning with biotechnological strategies for conservation and industrial application.

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42. Emerging Risk Mitigation Strategies in AM Medical Implants: A Systematic Review

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Additive Manufacturing (AM) has rapidly progressed from making prototypes to the production of patient-specific medical implants, necessitating robust strategies to ensure their safety and reliability. The study focuses on both process-related risks (such as porosity, residual stresses, dimensional inaccuracies, and surface roughness) and material/biological risks (including fatigue failure, corrosion, and biocompatibility issues). It examines techniques reported in the literature to reduce these risks, such as advanced process monitoring, simulation-based design optimization, post-processing methods (heat treatment, surface modification, sterilization), and quality control protocols. The review also highlights best practices in material selection, scaffold design, and patient-specific customization that contribute to safer implant production. By synthesizing current mitigation approaches, the paper identifies knowledge gaps for managing risk in AM medical implants. The result is a literature-based review of effective approaches to enhance reliability, safety, and clinical performance of additively manufactured implants.

43. Risks in Additive Manufacturing of Cardiovascular Implants: A Systematic Review

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Additive manufacturing (AM) has emerged as a transformative technology in cardiology, enabling the fabrication of patient-specific implants such as stents, scaffolds, and valves with high precision. Despite its potential, clinical adoption remains limited due to multi-faceted risks affecting performance, safety, and regulatory approval. This systematic review (2015–2025) synthesizes published research to classify these risks into five domains: manufacturing-level defects (e.g., porosity, surface irregularities), material issues (e.g., powder contamination, alloy variability), design-driven fatigue, biological risks (e.g., thrombosis, poor endothelialization), and regulatory gaps. The findings indicate that while manufacturing and material-related risks dominate current research, biological and regulatory assessments are significantly underexplored. The integration of Industry 5.0 principles with Multi-Criteria Decision-Making (MCDM) frameworks is proposed as a novel pathway to prioritize and manage these risks through AI-assisted monitoring and human-centric collaboration. This integrated approach could enhance safety, reliability, and accelerate the clinical translation of AM cardiovascular implants.

44. The Dual Role of Porosity in Additively Manufactured Implants: Risk vs. Biological Advantage

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This paper explores the dual role of porosity in additively manufactured (AM) medical implants by reviewing recent literature. Porosity is often considered a risk factor, as uncontrolled voids reduce mechanical strength, fatigue resistance, and corrosion performance, potentially leading to implant failure. At the same time, engineered porosity is a biological advantage, enhancing osseointegration, bone ingrowth, and long-term fixation. The review will discuss how porosity forms during different AM processes, its effect on both mechanical reliability and biological performance, and the characterization methods used to measure it. Case studies on titanium alloys, cobalt-chromium, and polymer-based implants will be summarized to highlight porosity performance trade-offs. The paper concludes by presenting porosity as a "double-edged sword," emphasizing the need for process control and design optimization to balance risks with biological benefits.

45. Towards Sustainable Additive Manufacturing: A Review on Waste Reduction, Energy Efficiency, and Circular Economy Approaches

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Additive Manufacturing (AM) is changing the manufacturing traditions by adopting resource efficiency, design flexibility, and on-demand manufacturing. The growing popularity of sustainable manufacturing reveals the necessity to learn about the environmental effects of AM in a holistic way. This paper examines sustainability in AM processes through the review of recent literature on waste reduction, energy efficiency, and material recycling. In the review, it is indicated that AM can considerably lower the wastage of production, support component re-use and repair as well as enhance the efficiency of resources. The major challenges are seen to be energy consumption and limitations in recycling metallic and polymeric powders. The insights guide researchers to optimize AM processes to serve the environment and improve circular manufacturing systems to optimize its processes.

46. Rooftop farming, a healthy way to grow vegetables: a review

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Rooftop farming has a great potential to deal with the challenges of urban agriculture and offers adaptable solutions for the current challenges, ranging from food security to ecological sustainability. This review article covers all the essentials required for the production of vegetables organically on top of the roof, creating topics for current research, technologies and their applications virtually. Beginning with the evolution of farming on house roof, various methodologies and systems including hydroponics, aeroponics, pot culture, compost culture and green-roof installations can be explored. All these green-roof methods provide number of ecological benefits, such as mitigating heat in urban areas, solving atmospheric dryness and keeping the house cool in urban areas, especially in extreme summers. Simultaneously, it also augments the social and economic status, including communal engagement and local food production, which will ultimately solve the problem of food shortage and chronic malnutrition, especially vitamin A, iodine and iron deficiency severely prevailing among children under the age of five years in the country. Rooftop farming is a sustainable strategy for improving food security by provides direct access to food and supplementary income to the land-less poor people during period of stress. It can be a year-round agent to supply fresh vegetables, which are essential for good health. Using this system of cultivation, one can grow vegetables without the use of fertilizers and pesticides by using organic sources. Furthermore, every individual can learn how to deal with the limitations and challenges associated with vegetable farming on roof, such as operational considerations, regulatory hurdles and resource constraints. Through this inclusive analysis, a roadmap can be prepared for urban planners, policymakers and stakeholders interested in harnessing the potential of rooftop farming.

47. Role of organic and inorganic component in mustard crop

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Abstract
The balanced integration of organic and inorganic nutrient sources plays a pivotal role in enhancing the productivity, soil fertility and sustainability of mustard (Brassica juncea L.) cultivation, Mustard, being a nutrient-exhaustive oilseed crop, requires adequate and balanced nutrition for optimum growth, yield and oil content. Sole dependence on chemical fertilizers often leads to soil nutrient imbalance, reduced microbial activity and long-term degradation of soil structure. Conversely, exclusive use of organic inputs may not fulfill the immediate nutrient demand of the crop. Therefore, integrated nutrient management (INM) combining both organic and inorganic components has emerged as an efficient strategy to sustain yield and improve soil health. Organic sources such as farmyard manure (FYM), vermicompost, poultry manure and compost enrich the soil with macro- and micronutrients, enhance microbial biomass and improve soil aggregation, moisture retention, and cation exchange capacity. In contrast, inorganic fertilizers provide readily available nutrients such as nitrogen, phosphorus, potassium and sulfur-critical for vegetative growth, flowering, and seed development in mustard. Studies have shown that the combined application of 50-75% recommended dose of fertilizers (RDF) with 25-50% organic amendments significantly improves seed yield, oil percentage and nutrient uptake efficiency compared to sole inorganic or organic treatments. Integrated applications also enhance soil enzymatic activities (dehydrogenase, urease, and phosphatase), reduce nutrient losses and promote residual fertility for succeeding crops in rotation systems. Furthermore, organic inputs help in mitigating greenhouse gas emissions and improving carbon sequestration potential, aligning with climate-resilient agriculture goals.

48. Effect of organic and inorganic component in oil quality of mustard crop

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Mustard (Brassica juncea L.) is an important oilseed crop widely cultivated for its edible oil and economic value. The quality and quantity of mustard oil are greatly influenced by nutrient management practices. In recent years, there has been growing interest in integrating organic and inorganic nutrient sources to enhance soil fertility, crop productivity, and oil quality in a sustainable manner. The present study was conducted to evaluate the effect of different combinations of organic and inorganic nutrient sources on the oil content and quality attributes of mustard. The experiment was laid out in a randomized block design with multiple treatments comprising farmyard manure (FYM), vermicompost, biofertilizers, and graded levels of chemical fertilizers (NPK). Observations were recorded on growth parameters, yield attributes, seed yield, oil percentage, and biochemical characteristics of oil such as fatty acid composition.

Results indicated that integrated nutrient management (INM) treatments significantly improved plant growth and seed yield over sole application of either organic or inorganic fertilizers. The combined use of organic manures with recommended NPK levels enhanced oil content and improved favorable fatty acids (oleic and linoleic acids), while reducing undesirable erucic acid levels. Improved soil organic carbon and nutrient availability under organic-inorganic blended treatments contributed to better oil biosynthesis and overall crop performance. The highest oil content and superior oil quality were obtained from treatments receiving 50–75% recommended dose of fertilizers (RDF) supplemented with organic sources.

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49. Effect of the organic and inorganic fertilizer on the quality of mustard oil

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The present study investigates the effect of organic and inorganic fertilizers on the yield and quality of mustard (Brassica juncea L.) oil. A field experiment was conducted using different nutrient management treatments, including farmyard manure (FYM), vermicompost and biofertilizers as organic sources, and urea, single superphosphate and muriate of potash as inorganic fertilizers. The treatments were applied individually and in various combinations to evaluate their influence on seed yield, oil content and physicochemical properties of the extracted mustard oil. Results revealed that balanced fertilization significantly influenced both yield and oil quality parameters. Plants treated with a combination of organic and inorganic fertilizers produced the highest seed yield and improved oil recovery compared to those treated with either source alone. Oils derived from organically fertilized plots exhibited higher iodine values, unsaturated fatty acid content and better oxidative stability, indicating superior nutritional quality. Conversely, inorganic fertilizer treatments enhanced oil yield but slightly reduced quality attributes such as flavor, color and shelf life due to higher free fatty acid content. The integrated use of organic and inorganic fertilizers proved to be the most effective strategy, optimizing both productivity and oil quality while maintaining soil health. The study concludes that sustainable nutrient management practices, emphasizing a balanced combination of organic and inorganic inputs, can enhance mustard oil quality and support environmentally sound agricultural production systems.

Keywords: Mustard (Brassica juncea), organic fertilizers, inorganic fertilizers, oil quality, fatty acids, sustainable agriculture.

50. Simulation of Autonomous Navigation in Urban Mobility

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This work presents a deterministic simulation system built from the ground up in Unreal Engine 5, specifically designed to address the challenge of testing urban autonomous vehicles. The platform was chosen for its advanced physics engine and its ability to create photorealistic, dynamic city environments. The core of our contribution is a “deterministic” system, meaning its behavior is entirely predictable: given the same starting scenario, the vehicle will perform the exact same actions every time. This is achieved by implementing a transparent, rule-based decision-making engine to manage the vehicle’s behavior. Unlike complex ”black box” approaches, this rule-based system operates on a clear set of logical ”if-then” commands, making every decision transparent and

52. Exploration of Some Wild Food Plants Used by Local Inhabitants of Saharanpur District of the Uttar Pradesh State- A Report

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The rich biodiversity of the Saharanpur district of Uttar Pradesh harbors a wide array of wild food plants (WFPs), which play a significant role in the sustenance and cultural traditions of rural and tribal communities. This study documents and analyzes the traditional knowledge of local inhabitants regarding the collection and use of wild food plants. Using ethno botanical surveys conducted in various villages and forest fringe communities, a total of 25 wild food plant species were identified and classified based on their local names, plant parts used, mode of consumption, availability, and cultural importance. The study highlights the critical role of WFPs in local food security, dietary diversity and traditional healthcare systems, particularly in regions facing environmental and socio-economic chal-lenges. The findings highlight the importance of WFPs in Sincere dietary diversification, food security and conservation of indigenous knowledge. Urgent efforts are required to document and preserve this knowledge in the face of socio-economic changes and biodiversity loss. This research reveals that the district, have predominantly herbaceous plants, with leaves and fruits being the most frequently consumed parts. A notable characteristic of many identified plants is their dual food-medicinal properties, which underscores the integrated nature of traditional knowledge systems in the region. The continued reliance on WFPs by local populations emphasizes their importance for nutritional supplementation and resilience against food scarcity. This report advocates integrated approaches to promote the sustainable use and conservation of these invaluable bioresources.

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53. Addressing Persistent Pollutants: The Role of Phytoremediation in Achieving Water Quality Sustainability Goals

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Toxic heavy metals pose a critical environmental and public health threat, and hospital effluent is a significant source of persistent, non-degradable pollutants. These metals have a detrimental impact on human health, with a particular emphasis on the cardiovascular system, kidneys, and central nervous system. Environmentally, their toxicity poses a threat to wildlife by bioaccumulating in terrestrial and aquatic food chains, diminishing soil fertility, and harming beneficial soil microorganisms. Conventional wastewater treatment facilities are significantly ineffective in the removal of these specific metallic contaminants.

Sustainable, biotechnology-driven solutions are required to address this challenge. One of these solutions is phytoremediation which is an eco-friendly and low-cost approach. This method employs plants and their associated microbes to absorb detoxify pollutants. In particular, aquatic and terrestrial plants such as Saccharum munja (Munja grass), Brassica juncea (Indian mustard), Trifolium alexandrinum (Berseem clover), and Pennisetum purpureum (Napier grass) have demonstrated exceptional potential to phytoextract and phytostabilize heavy metals from contaminated water.

The efficacy of these phytoremediation systems can be considerably improved by the integration of modern biotechnological tools, such as microbial augmentation or genetic enhancement of the plants, to improve uptake efficiency and tolerance. This green-technology approach directly contributes to SDG 6 (Clean Water and Sanitation) by emphasizing the removal of heavy metals. In addition, it protects ecosystems by preventing metal toxicity, thereby promoting SDG 14 (Life Below Water) and SDG 15 (Life on Land).

54. Simulation of Autonomous Navigation in Urban Mobility

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The widespread deployment of autonomous vehicles (AVs) in urban environments is predicated on proving their safety and reliability. Traditional real-world validation is economically prohibitive, temporally unfeasible, and ethically untenable due to public risk. High-fidelity simulation has thus emerged as the only viable alternative. This work introduces a deterministic simulation architecture, engineered within Unreal Engine 5, to validate safety-critical logic for urban AVs. The platform's core contribution is its deterministic, rule-based decision-making engine. This "glass box" approach, unlike opaque "black box" models, ensures that for any given scenario, the vehicle's behavior is perfectly predictable, repeatable, and auditable. The primary application is the rigorous testing of collision avoidance algorithms in hazardous scenarios. This research demonstrates that a high-fidelity, deterministic framework is an indispensable tool, providing a safe, cost-effective, and trustworthy bridge between algorithmic design and real-world deployment. Index Terms—Autonomous Vehicles, Autonomous Navigation, High-Fidelity Simulation, Unreal Engine 5, Collision Avoidance, Deterministic Systems

55. Machine Learning Based Evaluation of Student Performance in Blended Learning Environments

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To increase flexibility and pupil engagement, blended learning combines traditional classroom settings with web based learning. Despite its growing popularity, a quantitative assessment of its efficacy in comparison to conventional classroom teaching approach is still necessary. Using offline test data collected from both traditional and blended learning setups, the present study analyzes and forecasts student performance using supervised machine learning (ML) methods. Students' final test marks from a variety of disciplines are included in the data collection process, and each record is labeled with the learning discipline mode. The classification accuracy of several machine learning models, such as Decision Tree, Random Forest, Support Vector Machine, and Logistic Regression, is compared and evaluated by using the process of training and testing. Standard measures including accuracy, precision, recall, and F1-score are used to assess and analyze every model's performance. Comparative analysis presents the best method for modeling academic achievement and machine learning's predictive capacity in educational data analyzing. An algorithmic approach for measuring and evaluating instructional modes supports data-driven educational system approach design in computational learning analytics. This study uses selected and limited but important performance data to reveal how machine learning can maximize blended learning outcomes.

Keywords: Machine Learning, Machine Learning Algorithms, ML Model performance, Blended Learning, Education Technology, Open-Source Tools for learning and Student Performance.

56. A Privacy-Preserving Framework for Data Processing in Fog and Edge Computing Environments

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In now a day we are adopting fog and edge computing devices in modern digital infrastructure increasingly, the privacy and security of these devices are major concern. In this research we proposed new ways how to keep information secure whenever it is transmitted to somewhere else. This research also uses a secrete line of code to keep information secure. It's faster, uses less internet, and keeps your privacy better because your data stays on your device instead of going anywhere else. To enhance security and compliance with regulations even further, customized differential privacy techniques are integrated to adjust privacy controls to diverse data types and user requirements. Case studies in the context of IoT and healthcare scenarios validate the performance of the framework through improved system efficiency, data value, and privacy guarantee. Directions for future research are illuminated by presenting current challenges with device heterogeneity, secure node-to-node communication, and enforcement of privacy policies. A workable and scalable approach to finding a balance between strong data privacy and operational necessities in distributed edge and fog computing paradigms is described in the present paper. We use GPS trajectory dataset with machine learning model Federated LSTM. The paper is organized in Introduction, literature review, proposed methodology, result and in last conclusion sections.

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57. A Review of Perceptual Hashing and Adversarial Deep Learning Approaches

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The growing number of digital images on the internet has made it crucial to quickly and easily recognize related images from a range of domains. Perceptual hashing is the most used technique for retrieving such near-duplicate images. The need for reliable and efficient near-duplicate image retrieval systems has grown due to the exponential expansion of digital imagery. The development of perceptual hashing methods and their combination with adversarial machine learning and convolutional neural networks (CNNs) are the main topics of this review. Fast similarity detection is made possible by perceptual hashing, which provides compact, transformation-resistant representations. While adversarial learning adds resilience against deliberate disturbances and attacks, CNN-based feature extraction has improved discriminative power. In this survey of the literature, important approaches, comparative evaluations, and new difficulties in developing safe and intelligent picture retrieval systems are highlighted. The paper also suggests potential paths for enhancing perceptual hashing systems' interpretability, scalability, and resilience in deep learning situations.

58. Comparative Study of Deep Learning and Classical Noise Removal Techniques for Plant Leaf Disease Detection

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Abstract: The detection of plant leaf diseases is a critical component of smart agriculture. The success of plant leaf disease detection using deep learning heavily depends on the quality of input images. Noise in images caused by environmental factors, imaging devices, or preprocessing steps can degrade the performance of deep learning models. In order to improve the disease detection performance in plant leaves using deep learning, this research study addresses the effects of various noise removal filters during the pre-processing stage. The study involves account of four plant species (apple, potato, tomato, and grape) of the PlantVillage dataset. This study presents a comprehensive comparison between classical noise removal filters like Median, Gaussian, Bilateral, and Non-Local Means and advanced deep-learning based denoisers such as REDNet, MWCNN, PRIDNet, and CBDNet. Each technique is evaluated as a pre-processing step for deep convolutional neural networks (CNNs) used in disease classification. Performance comparison on PlantVillage datasets show that deep denoisers significantly enhance image quality and classification accuracy, with CBDNet achieving the best overall performance (accuracy = 97.9%) compared to classical methods (Median = 92.4%). The findings confirm that learned denoisers are more robust and effective for agricultural applications.

Keywords: Plant Disease Detection, Image Denoising, Deep Learning, CBDNet, MWCNN, REDNet, PRIDNet, Median Filter, Noise Removal.

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59. Agentic Retrieval-Augmented Generation for On-Premise Infrastructure: Enhancing Security and Performance for Enterprise Knowledge Management

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In the digital age, enterprises deal with copious amounts of data. A large amount of this data is unstructured, which poses big challenges when it comes to knowledge management. The primary problems associated with the usage of cloud based Large Language Models (LLMs), are the security and privacy risks[1], which are a major barrier to its adoption in regulated industries[2]. This paper presents a complete blueprint for an agentic Retrieval Augmented Generation (RAG) system this is designed for secure, on-premise enterprise knowledge management. The architecture that has been proposed by us, addresses the possible data sovereignty concerns, by ensuring that all of the data processing remains confined within local infrastructure. The system's methodology is divided into two core components. That is a document processing framework, which uses open source tools to ingest, chunk, and embed the various internal document types into a local ChromaDB vector store. Along with it, is an innovative multiagent RAG pipeline, which is orchestrated by an intelligent Agent Orchestrator. The Orchestrator is used to dynamically handle complex queries. This agentic approach allows the system to carry out advanced capabilities like multistep planning, tool use, and a Validate & Refine loop. This not only enhances accuracy, but also its reliability beyond the traditional single pass RAG systems.

60. Environmental Protection and Food Safety: Two Sides of the Same Coin

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Food safety and environmental protection are closely connected, forming a foundation for public health and sustainable development. In India, over 100 million people suffer from foodborne illnesses each year, largely due to environmental degradation. Soil contamination, polluted water, and climate change compromise food safety, as heavy metal accumulation in rice, pulses, and vegetables has been reported from Cuttack district, Odisha. Global issues like cadmium pollution further show how environmental hazards directly lead to foodborne risks. The SFSI by the Food Safety and Standards Authority of India highlights sharp contrasts—while Kerala, Tamil Nadu, and Jammu and Kashmir lead in standards, many regions lag due to poor infrastructure, limited labs, and lack of awareness. Environmental pressures such as 17.8 percent carbon emissions from Gujarat's Kutch district and rising food waste worsen agricultural vulnerabilities. Innovations like traceability systems, mobile food testing vans, and sustainable packaging offer solutions to bridge the food–environment gap. Frameworks like the Food Systems Dashboard emphasize integrated and sustainable approaches. Aligning India's food systems with healthier diets and resilient farming practices is vital to mitigate climate risks. Linking environmental conservation with food safety is essential to reduce disease burden, improve public health, and ensure long-term food security.

61. Wheather Forecasting Integrating Recurrent Neural Networks with Data Assimilation for Scalable Data-Driven State Estimation

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Data assimilation (DA) can be combined with machine learning to estimate the state of a system in real time using only data. In this approach, recurrent neural networks (RNNs) are used as substitute models for key parts of the traditional DA cycle in numerical weather prediction (NWP). This includes replacing the conventional forecast model, the forecast error estimates, and the linearized models used for updating the system.
The RNNs can be set up using DA techniques so that their internal states are directly updated with real observations. The studies show that this method can successfully estimate the current state of a system and repeatedly initialize short-term forecasts, even without a standard numerical forecast model. Moreover, these combined RNN-DA methods can handle larger, more complex systems by using techniques like dividing the domain into smaller regions and running computations in parallel. This makes them practical for real-world weather prediction applications.

Keywords: Data Assimilation · Recurrent Neural Networks · Reservoir Computing · Numerical Weather Prediction

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62. Innovation and Application of Machine Learning

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At this time the Machine Learning is fast-growing technology. It revolute in differ-differ industries. Such work offers the potential for significant impact no merely in domains in applications but also in Machine Learning itself. Predicting innovation and outcomes at firm level continues to be an important but challenging goal for researcher and practitioners alike. In this study, multiple Machine Learning models encompassing both ensemble-based and single-model approaches, those were applied to the data from Community Innovation Survey. From a methodological standpoint, the study demonstrates how machine learning techniques can streamline the decision-making process by lowering the number of variables that must be taken into account when examining the companies and by producing precise and understandable results. This research paper also shows the value of Machine Learning in the quality of data, features and algorithm besides the stating the difficulties of data analysis. The Methods include random forest, gradient boosting frameworks, supporting vector machine, neural network and logistic regression, each with hyper-parameters optimized through Bayesian search routines and evaluated using corrected cross-validation Techniques. Overall, the result indicates that ensemble method generally provides robust classification performance for innovation predicting tasks.

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63. Effect of Lifestyle and Diet on Thyroid Hormone Regulation in Different Age Groups

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This study is a comprehensive synthesis of the current research regarding the influence of diet and lifestyle on thyroid hormone regulation at different human life stages. The HPT axis, a complex neuroendocrine feedback loop, is the main mechanism for keeping thyroid hormone levels within the normal range. Although genetic predisposition and autoimmune diseases are the major causes of thyroid dysfunction, a large number of studies point to modifiable factors such as diet, stress, sleep, and physical activity that may have considerable effects onthis axis.

This report deliberates on the requirements of the different micronutrients closely attendant around diet, notably iodine, selenium, zinc and iron, which are the direct sources of the hormone synthesis and metabolism process. Furthermore, it discusses the novel idea of the gut-thyroid axis and the overall effect of stress on the HPA-HPT axis. One of the critical points raised is the subtle, age-dependent effect of these factors, where the essential developmental roles in children are distinguished from the diagnostic difficulties caused by the atypical symptom presentation in the elderly.

The investigation uncovers that the interrelation between these factors and thyroid health is, in most cases, non-linear and bidirectional, thus, it is difficult to provide simple, universal guidelines. The paper ends with the assertion that a person-centered, holistic approach is indispensable for thyroid health diagnosis and management and also affirms the need for future research to help shed light on the causal mechanisms through longitudinal studies.

64. Hybrid Waterfall–Agile–DevOps Framework for the Banking Sector

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One of the main factors leading to the digital transformation of the financial sector is the advent of various technological innovations. Among others are artificial intelligence. The customers are demanding that banks provide them with quick, tailored services, and at the same time, regulators are implementing stringent requirements for security and paperwork.. Sequential stages with widespread documentation offer predictability and compliance in classical waterfall processes but are rigid and costly to change. Agile methods provide iterative development and continuous customer feedback, which improve flexibility and time-to-market. However, they tend to lack the formalized reporting and approval checkpoints of banking. DevOps introduces automation and continuous integration/continuous deployment to speed up delivery and enhance reliability, but requires large technical maturity and can skip over regulatory procedures. No one method satisfies all requirements. Waterfall by itself inhibits innovation, agile by itself threatens compliance shortfalls, and DevOps by itself can potentially underplay governance. To close this gap, we are introducing a hybrid waterfall-agile-devops framework for banking. Our framework applies waterfall methodologies for preliminary requirements gathering and regulatory sign-off, then agile sprints for iterative building, and a DevOps layer for auto-testing and release. This combination provides a closed-loop feedback process at all phases. The model is designed to facilitate faster innovation without compromising on compliance and security.

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65. A Conceptual Framework for a Hybrid AI Approach to Fake News Detection

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The rapid proliferation of fake news on social media platforms presents a significant challenge to information integrity. Due to the volume and velocity of this content, manual fact-checking is untenable. This paper proposes a conceptual framework for a real-time, hybrid AI system for fake news detection. The proposed approach moves beyond single-modality analysis by integrating two critical forms of AI: a Transformer-based model to analyze the linguistic and semantic features of the content, and a Graph Neural Network (GNN) to model the social context and propagation patterns of the information. By examining both the content and its context in tandem, it is hypothesized that such a framework could achieve a more robust and accurate classification of news veracity. This paper outlines the architecture of such a system, discusses its theoretical advantages over existing models, and lays the groundwork for future empirical validation.

66. Multimodal Emotional Communication for Human–Robot Interaction (MEC-HRI)

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Fully seamless and intuitive human–robot interaction (HRI) communication is still a major challenge. Multimodal communication, which synthesizes speech, gestures, facial expressions, and physiological signals, has been shown to improve robots' social responsiveness and empathy .We introduce the Multimodal Emotional Communication HRI (MEC-HRI) system, which enables robots to detect, understand, and respond to complex human emotions and intentions in real time .The MEC-HRI framework uses various sensors, such as microphones, cameras, eye trackers, and physiological monitors, to capture a complete picture of a user's emotional state. Deep learning models extract features (e.g., CNNs for facial expressions, spectrogram-based networks for speech, transformer language models for text) and situational context to infer the user's affective state. The robot then produces rich responses, including synthesized speech, facial expressions, and co-speech gestures, that are customized to the inferred emotions. We tested MEC-HRI in various environments (guided tours, collaborative games, family care, VR simulations) and found that it significantly outperforms unimodal baselines in emotion recognition accuracy, response delay, and user engagement. The system also uses continuous learning, adapting its models over time through feedback. MEC-HRI has promising applications in service robotics, educational robotics, healthcare, and social companion robots, contributing to the next generation of socially intelligent robots for empathetic and meaningful HRI.

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67. Generative AI: Applications, Challenges, and Future Directions

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Generative Artificial Intelligence (AI) is quickly changing how people create knowledge, ideas, and innovation in many fields. This study is motivated by the need to understand not only the useful applications of generative AI in areas like healthcare, education, entertainment, and design, but also the challenges it brings, such as ethical issues, bias, and lack of trust. The importance of this research lies in the fact that, while the technology is growing fast, there are still limited discussions about its long-term impact and how it should be used responsibly.

The purpose of this paper is to fill that gap by reviewing current uses of generative AI, studying the challenges it faces, and suggesting possible future directions for safe and sustainable growth. The method focuses on analyzing existing studies and real-world examples to point out both opportunities and limitations. Findings show that generative AI is already helping in areas like personalized learning, medical research, and creative content, but issues such as fairness, transparency, and proper regulation remain unsolved.

In conclusion, this study gives a balanced view by showing both the benefits and risks of generative AI. It highlights the need for ethical rules and careful planning to guide its development in the future.

68. The Transformative Landscape of Agentic AI. A Review of Technologies, Applications, and Ethical Implications

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Artificial intelligence has advanced far beyond early rule-based approaches, evolving into adaptive and autonomous systems that operate with minimal human intervention. Within this progression, Agentic AI has emerged as a distinctive paradigm, characterized by independence, proactive decision-making, and the ability to pursue goals in dynamic environments. Unlike conventional or generative AI, which primarily responds to inputs, Agentic AI integrates reasoning, planning, and collaboration to achieve complex, multi-step objectives. This paper reviews the fundamental concepts, recent developments, and practical applications of Agentic AI across multiple domains. It explores the evolution of system architectures, the role of multi-agent frameworks, and reinforcement learning techniques while highlighting real-world implementations in healthcare, finance, education, energy, and transportation. Ethical and governance challenges—such as transparency, security, fairness, and alignment with human values—are also examined. Finally, the study identifies future directions focused on scalable system designs, explainable and trustworthy models, and globally coordinated regulatory approaches.

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70. Artificial Intelligence in Healthcare

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This paper offers a thorough analysis of the use of Artificial Intelligence (AI) in healthcare of the future. By combining the results of academic research, open-source reports, and case studies, the report illuminates AI's transformative power in the clinical, administrative, and financial areas. The paper exemplifies the literal possibilities of AI technology to revolutionize in fields like medical testing, new-drug research, fast and cheap automation of administrative tasks, and identifying at-risk patients. At the same time, it actively converses with the skepticism about ethical, legal, and operational challenges that the adoption of AI impedes. Besides algorithmic bias, data privacy, the question of who is responsible for AI-related errors, and the "black box" issue, key topics discussed in the paper, are some of the most pressing concerns.

The article presents a comprehensive method for AI confirmation and offers real-world solutions to lessen the risks and promote the creation of reliable AI systems. The final verdict is that AI should be considered more than just a mere instrument, as it is a major factor that leads to the restructuring of healthcare and requires a principled and collaborative approach to make sure that its advantages are felt at the right place and in the right way.

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71. FaiR-CEx: An Analytical Review of a Framework for Fair and Robust Counterfactual Explanations

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The proliferation of complex machine learning models in high-stakes decision-making domains, such as finance and healthcare, has created a pressing need for systems that are not only accurate but also transparent and fair. This need is particularly acute when dealing with imbalanced datasets, where models are inherently biased towards the majority class, and explanations for predictions about the minority class are both critical and difficult to obtain. Existing research has begun to address the intersection of explainability and class imbalance, but often overlooks the crucial dimension of algorithmic fairness. A model's explanation, particularly a counterfactual one that suggests a path to a more favorable outcome, can itself be a vector for discrimination if the suggested recourse is inequitable across demographic groups. This paper identifies a critical research gap: the absence of a unified framework that co-optimizes for accuracy, explainability, and fairness in imbalanced learning contexts. We propose FaiR-CEx (Fair and Robust Counterfactual Explanations), a novel generative framework that extends the state-of-the-art Explainable Generative Adversarial Network (EXGAN) by explicitly incorporating fairness constraints into the counterfactual generation process. FaiR-CEx introduces a novel "Fairness Critic" component within its adversarial architecture, which is trained to detect protected attributes from the generated recourse vectors. The generators are, in turn, trained to fool this critic, thereby learning to produce explanations whose "cost" is statistically independent of group membership. Through a comprehensive set of experiments on benchmark fairness datasets (Adult Census Income and COMPAS), we demonstrate that FaiR-CEx generates counterfactuals that are not only valid and plausible but also significantly more equitable, as measured by both standard group fairness metrics and a novel "Intersectional Recourse Gap" metric.

72. Does AI Replace Human Jobs or Work

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The emergence of Artificial Intelligence (AI) creates a basic economic paradox: on the one hand, it can bring trillions to the world economy, but at the same time, risk massive job displacement. This paper unpacks this two-pronged employment effect, with India being a primary case study to investigate the global phenomenon. From the analysis of academic literature and policy reports, a clear trend emerges. In the near future (2-5 years), AI will enhance human capabilities instead of replacing them, largely by automating mundane tasks. But the long-term horizon (10+ years) is uncertain, and there is a high risk of job loss that will require huge reskilling efforts. Artificial Intelligence (AI) is quickly emerging as a revolutionary influence across various sectors, altering how individuals carry out tasks, interact with each other, and innovate. Experts, policymakers, and community leaders are discussing whether AI will eliminate jobs, alter the workforce environment, or achieve a combination of both. This paper explores the global implications of AI adoption, with particular focus on India—a nation where rapid technological growth intersects with a vast labor force. Drawing on secondary sources, including academic studies, industry reports, and government policies, this research investigates both the opportunities and challenges AI presents. The study finds that AI will not wholly replace humans, but rather transform work by automating low-skill jobs and demanding higher levels of adaptability, creativity, and ethical reasoning. Furthermore, the paper argues that human qualities—such as empathy, moral judgment, and cultural intelligence—remain irreplaceable by AI.

73. The Atrophy of Cognition: A Comprehensive Examination of How Over-reliance on Artificial Intelligence Poses a Threat to Human Brain Function and Mental Health

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The extensive incorporation of artificial intelligence (AI) into everyday life poses a considerable, twofold challenge to human thinking. Although AI provides significant advantages in efficiency, productivity, and information accessibility, an increasing amount of evidence indicates that excessive dependence on these tools may result in a condition called cognitive atrophy. This document offers an in-depth analysis of the cognitive and psychological dangers linked to the widespread and unexamined application of AI. Based on a combination of findings from neuroscience, cognitive psychology, and empirical research, we assert that entrusting essential cognitive tasks to AI could lead to a measurable decline in critical thinking, problem-solving abilities, and memory retention. This report transcends theoretical worries to deliver an evidence-driven analysis of the potential dangers presented by this change in the human-machine dynamic, which promotes the delegation of essential cognitive tasks and jeopardizes their basic integrity.

74. A Hybrid AI-Physics Ensemble for Multi-Horizon Weather Forecasting

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Reliable forecasts of key weather conditions—such as temperature, humidity, wind and rainfall—require combining traditional meteorological models with modern artificial intelligence (AI) methods. We propose a complete framework that brings together simple statistical approaches (like linear regression, functional regression and probabilistic classifiers such as Naïve Bayes or chi-square tests) with advanced deep learning models, including artificial neural networks (ANNs) and Transformer architectures. In this approach, atmospheric data is represented in a three-dimensional format that captures space and time (latitude, longitude, and pressure levels). The data is then processed using a Transformer-based encoder–decoder system. The training process uses multiple objectives at once: predicting weather variables (regression tasks) while also enforcing physical consistency through physics-based constraints. To improve reliability, the model generates probabilistic forecasts by using an ensemble of neural networks. This work provides not just single-value predictions but also distributions, enabling the calculation of uncertainty measures such as quantiles and Continuous Ranked Probability Scores (CRPS). In benchmark tests with reanalysis datasets, our hybrid model significantly outperformed both traditional numerical weather prediction (NWP) methods and purely data-driven approaches. It reduced errors across multiple variables (measured by RMSE) and improved anomaly correlation by about 10–20%. Moreover, the ensemble forecasts produced better-calibrated probabilities, surpassing the leading ECMWF ensemble system on more than 97% of evaluation targets.

75. Fake News Detection Based on ML and NLP Techniques

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we are living in the era of digital platforms and advanced technologies the internet has achieved worldwide reach making it accessible in nearly every part of the globe individuals increasingly rely on online channels to gather updates and knowledge however inaccurate material can reach millions of people within a very short period through social networking sites such as WhatsApp, Facebook and twitter the circulation of false or fabricated information may cause severe consequences by shaping public opinion influencing societal interests and transforming the political social and economic landscape such misleading information can also impact international events therefore it becomes extremely difficult to validate the enormous volume of digital data using traditional methods of verification for differentiating genuine from deceptive material there is an urgent requirement for automated mechanisms capable of identifying false information. This paper demonstrates the method of detecting misinformation and fake news through machine learning (ML). This method uses a combination of natural language processing (NLP) techniques, such as using the algorithms KNN and SVM and monitoring algorithms to differentiate and separate different ideas and news articles. This system analyses text material and checks its reliability by using slanguage papers and cross sources. This system aims to help users check global information by reducing the spread of fake news and misinformation.

76. Cloud Computing: New Developments, Performance, Security and Upcoming Issues

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Abstract: Security, performance benchmarking, and identity management in multi cloud environments have gained more attention in recent years and cloud computing is still evolving rapidly. This paper reviews recent studies carried out in 2023 and 2025 to identify current threats, systematic advancements in performance evaluation and security best practices. Look at surveys of cloud security posture in different regions. Reports on technical debt related to Identity and Access Management (IAM) and empirical benchmarks (like Tail Bench++). The paper also examines the impact of sampling on benchmarking results and performance variability in stream processing. The conclusions are offer future directions to improve the security, economy and dependability of cloud adoption based on the survey and its results.

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77. Deconstructing the Promise: An Analysis of Promise Polyfill Architecture

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The JavaScript event-driven programming paradigm has come a long way thanks to the use of promises, which serve as an alternative to callbacks and form the basis of JavaScript's async/await syntax. Although JavaScript promises are easily found everywhere, few developers really know what goes on under the hood of a promise. This paper is an explanatory study of JS promises under the hood based on a custom promise polyfill. We describe the underlying core state machine of Promise resolution and rejection, describe how callback execution is scheduled using the microtask queue, and show how higher-order combinators are built on top of the primitives. Through walkthroughs of annotated code along with execution-flow diagrams, we seek to clarify the Promise abstraction and offer a clear conceptual model of its behavior. Our work emphasizes the importance of microtask queue in guaranteeing controllable asynchronous behavior. By making such inner mechanics visible, the paper gives educators and practitioners alike an open window into Promises, enabling them to gain better insight into promise-based programming in JavaScript and Node.js.

78. Artificial Intelligence Impact on Education

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This paper offers a thorough analysis of the use of Artificial Intelligence (AI) in healthcare of the future. Artificial intelligence (AI) creates academic landscape, which introduces a double use technique with capacity for both intensive progress and significant resolution. This letter provides a comprehensive synthesis of the versatile effects of AI on education, and examines its historical development, current applications, empirical effects and significant moral and educational challenges. The central argument suggests that AI provides enough, empirically supported benefits for learning and improving institutional efficiency, but at the same time shows educational integrity, important thinking and malicious risk of education. Review of widespread research methods, including metaanalies, qualitative case study and larger studies, reveal a complex image. Quantitative meta-analysis is constantly looking for a large, positive general effect for AI-based educational intervention, especially for applications associated with generative AI and chatbots. However, qualitative data from students and teachers highlight widespread concerns about accuracy, supernators, algorithm bias and privacy. This letter states that successful integration of AI is not just a matter of technical use, but it requires a systemic educational and moral reality. The future of AI in education rests on the development of new assessment paradigms that prefer the process, the cultivation of significant AI prescription among all stakeholders, and to ensure that instead of reducing technology, rather than the original humanitarian goals of learning, a strong, a strong, a strong, a strong, human centenary centenary installation.

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79. Heart Disease Prediction

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Heart disease is one of the most critical health concerns across world and responsible for millions of deaths each year. Detecting it early is important, as early treatment can save lives and improves health. The problem with traditional methods of diagnosis are as they are complex, expensive to perform, time consuming and requires much resources. These methods may sometimes fail to provide accurate predictions for all patients. With the rapid growth of healthcare data, machine learning provides a powerful alternative for predicting heart disease in a faster and reliable way. In this work, we present a heart disease prediction system that uses various Machine Learning algorithms including Logistic Regression, K-Nearest Neighbour, Decision Trees, Naïve Bayes, Random Forest, Gradient Boosting, XGBoost.

Patient data such as age, chest pain type, blood pressure, cholesterol levels and other clinical factors. Our results show that ensemble methods, particularly Random Forest and XGBoost, achieve higher accuracy and consistency than traditional models i.e, better than traditional models. To make the system more trustworthy for medical use and to ensure the system is not a “BLACK BOX” (it gives predictions but doesn’t explain why), we also apply AI techniques to highlight the most important factors influencing predictions. Beyond just prediction, the value of this work lies in its ability to support doctors in decision making, reduce delays and lower costs. By combining technology with medical knowledge, this system offers a practical, cost effective. The aim of this research is not only to advance prediction accuracy but also to contribute toward saving lives by making healthcare more patient cantered.

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80. Artifical Neural Network

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Artificial Neural Networks (ANNs) are now a core element of contemporary artificial intelligence, providing computational models drawn from the brain-like interconnectedness of the human brain. The networks consist of artificial neurons in layers, and they can process data, identify patterns, and yield valuable insights. As opposed to conventional algorithms that rely on pre-defined rules, ANNs learn through examples, adjusting their internal parameters through training and progressively enhancing performance. This flexibility allows them to solve intricate, nonlinear, and ambiguous problems where standard techniques are not adequate. The development of ANNs has been spurred by increases in computational power, access to large databases, and better training algorithms. Deep learning, a subdiscipline of ANNs using several hidden layers, has especially revolutionized artificial intelligence and produced better outcomes in image recognition, speech processing, natural language processing, and decision-making tasks. These feats have made ANNs the driving force behind numerous real-world applications. Functional implementations of ANNs consist of computer vision systems for medical imaging, facial recognition, and self-driving cars; speech technologies for voice-based assistants and real-time translation; and natural language models for sentiment analysis, question answering, and text generation. In medicine, ANNs are utilized in disease detection, drug discovery, and personalized treatment planning, thereby making them more efficient and precise. Though successful, there remain setbacks. The black box nature of ANNs' decision-making process questions their interpretability, whereas their high resource requirements and large data inputs restrict their accessibility.

81. Stock price prediction using machine learning

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We propose an advanced hybrid model that augments the traditional LSTM–GNN framework with modern AI components such as self-attention mechanisms, Transformer layers, and multi-modal input features. This enriched architecture is designed to capture a broader spectrum of influencing factors in stock price dynamics. Long Short-Term Memory (LSTM) networks efficiently model temporal dependencies, while Graph Neural Networks (GNNs) represent inter-stock relationships. The addition of graph attention networks (GAT) and Transformer-inspired modules allows the model to weigh both temporal and relational information dynamically. Our experiments on historical stock datasets show that the enhanced model achieves significantly lower prediction error than standalone models. In particular, we observe further MSE reductions beyond the 10.6% improvement reported for the original LSTM–GNN hybrid, consistent with gains found in similar architectures. These results underscore the value of integrating attention-based AI techniques into financial forecasting models.

82. Heart Attack in Children: A Rare but Serious Condition

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Pediatric acute myocardial infarction (AMI), while a rare and often life-threatening condition, presents a Pathophysiological challenge compared to its adult counterpart. Unlike the predominant etiology of atherosclerotic coronary artery disease seen in adults, the genesis of AMI in the pediatric population is most frequently rooted in a diverse array of underlying conditions. This includes, but is not limited to, congenital anomalies of the coronary arteries (such as anomalous left coronary artery from the pulmonary artery), systemic inflammatory vasculitides like Kawasaki disease leading to coronary artery aneurysms, inherited metabolic disorders af fecting myocardial function, and primary coagulation abnormalities predisposing to thrombosis. Given these unique etiologies, the clinical presentation, diagnostic modalities, and therapeutic interventions for pediatric AMI diverge significantly from established adult protocols. This comprehensive review aims to synthesize the current understanding of pediatric myocardial infarction. We will delineate the specific pathophysiological mechanisms driving this condition, outline the multi-modal diagnostic approaches critical for timely and accurate identification, and detail the evidence-based management strategies, including both acute and long-term care. Furthermore, this paper will explore the prognostic factors influencing patient outcomes and discuss the evolving role of preventive measures in at-risk pediatric populations. By consolidating this critical information, we seek to provide a foundational resource for clinicians, researchers, and healthcare professionals to enhance the recognition, treatment, and longterm care of children affected by this complex and often devastating condition.

83. Composition of LLM models and ai agent by langchain generative AI

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The integration of large language models (LLMs) with agentic frameworks has emerged as a pivotal direction in the advancement of generative artificial intelligence. LLMs such as GPT, LLaMA and Falcon demonstrate exceptional capabilities in producing human-like text, reasoning over unstructured data and generalizing across diverse domains. Yet, when deployed in isolation, these models face critical limitations, including their inability to maintain persistent memory, restricted access to external environments and difficulties in grounding responses to real-world contexts. To overcome these challenges, frameworks like LangChain provide structured pipelines that combine LLMs with external tools, vector databases, APIs, and reasoning strategies, transforming them into autonomous AI agents. LangChain's agentic paradigm is built upon several foundational components. Chaining mechanisms enable sequential or parallel task execution by feeding outputs from one reasoning step into the next, supporting the construction of complex workflows. Memory modules extend beyond the stateless nature of LLMs by offering shortterm conversational context and long-term knowledge persistence, thereby improving adaptability across repeated interactions. Tool integration empowers LLMs to interact with search engines, code interpreters and specialized APIs, grounding their generative abilities in external data sources. Additionally, agent methodologies such as ReAct (reasoning and acting) provide structured decisionmaking rocesses that balance reasoning trace generation with action execution, resulting in more interpretable and transparent agent behavior.This composition enhances the functional scope of LLMs and enables impactful applications across domains including customer service, healthcare, education and enterprise automation. However, challenges remain in ensuring reliability, safety, and efficiency.

84. Diabetes Prediction Using Machine Learning

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Diabetes is a chronic disease that has the potential to cause a global healthcare crisis, with the number of people living with it projected to nearly double from 382 million to 592 million by 2035. The disease is caused by an increase in blood glucose levels, which can lead to frequent urination, increased thirst, and hunger. It is also a leading cause of blindness, kidney failure, amputations, heart failure, and stroke. The goal of this paper is to develop a system for the early prediction of diabetes with high accuracy by combining the results of different machine learning techniques. The study utilizes algorithms such as K-Nearest Neighbor (k-NN), Logistic Regression, Random Forest, Support Vector Machine (SVM), and Decision Tree. The accuracy of each model is calculated and the most accurate one is selected for diabetes prediction.

85. Renewable Energy as a Cornerstone of Climate Change Mitigation and Sustainable Growth

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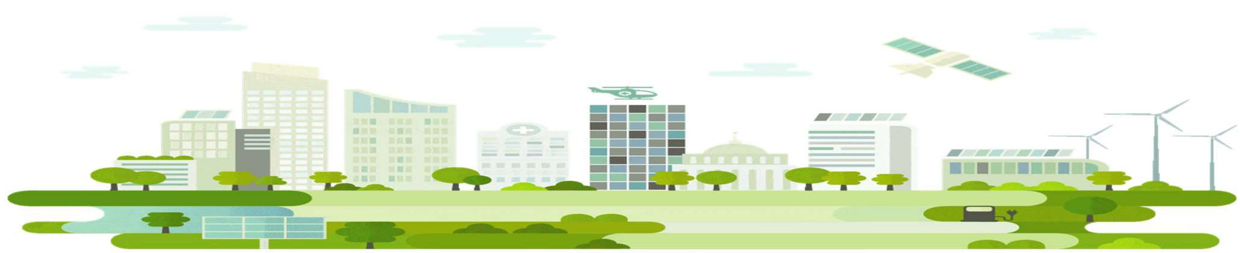
Renewable energy is emerging as one of the most powerful ways to protect our planet and slow down the pace of climate change. Unlike fossil fuels, which remain the leading cause of greenhouse gas emissions, clean energy sources such as solar, wind, hydropower, geothermal, and biomass offer a sustainable path forward. Embracing these energy alternatives not only reduces pollution but also strengthens global energy security and ensures a fairer, more resilient future for generations to come. Our growing dependence on fossil fuels continues to heat the planet, making the shift to renewable energy more urgent than ever. Global commitments such as the Paris Agreement, the United Nations Sustainable Development Goals (SDGs), and major climate summits all highlight the essential role of renewables in achieving a carbon-neutral world. Across continents, cleaner technologies are becoming cheaper, more efficient, and smarter, driven by innovation and global awareness. Yet challenges remain, including energy storage, intermittency, and high initial costs that continue to test the pace of progress. Beyond reducing emissions, renewable energy holds the power to uplift societies. It creates millions of new jobs, revitalizes local economies, and brings electricity to regions long left in the dark. Around the world, supportive policies and creative solutions are proving that clean energy is not just an environmental choice but also an economic and social opportunity. Renewable energy ultimately represents hope, a vision of a cleaner, brighter, and more sustainable world. With persistence, innovation, and cooperation, humanity can unlock its full potential and reshape the global energy landscape for a better future.



86. Prediction of PCOS Using AI

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Polycystic Ovary Syndrome (PCOS) is one of the most common endocrine disorders affecting women of reproductive age. It not only impacts fertility but also influences overall health and lifestyle. Typical symptoms include irregular menstrual cycles, ovarian cysts, hormonal imbalance, obesity, and insulin resistance. However, early detection remains a challenge because symptoms vary widely and often resemble general lifestyle-related issues. Conventional diagnostic methods such as ultrasound scans and hormone tests are costly, time-consuming, and not always reliable at the initial stage. To address these gaps, this study explores the use of machine learning (ML) algorithms for early PCOS prediction. Women with PCOS often face complications such as acne, excessive hair growth, sudden weight fluctuations, and infertility, which significantly affect physical and emotional well-being. Despite its high prevalence, PCOS is frequently underdiagnosed due to overlapping symptoms with common lifestyle problems such as stress, obesity, and irregular routines. Delayed diagnosis increases the risk of long-term complications, including type-2 diabetes, hypertension, and cardiovascular diseases. Traditional diagnostic approaches—such as ultrasound imaging, hormonal blood tests, and clinical examinations—are useful but expensive, time-consuming, and inconsistent at the early stage of detection. In many regions, limited access to advanced healthcare facilities further complicates timely diagnosis, leaving a significant portion of women undiagnosed or misdiagnosed.

87. SentinelMind: AI-Enhanced Early Warning System for Cyber Threats

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The escalating sophistication and frequency of cyber threats necessitate a paradigm shift from traditional, reactive cybersecurity measures to proactive, predictive defense systems. This paper introduces SentinelMind, an AI-enhanced early warning system for cyber threats. SentinelMind leverages a combination of machine learning (ML), deep learning (DL), and natural language processing (NLP) to analyze vast, disparate data sources—including network traffic, system logs, threat intelligence feeds, and open-source intelligence (OSINT)—to detect, predict, and mitigate potential attacks before they can cause significant damage. The system's core innovation lies in its ability to go beyond signature-based detection, identifying subtle anomalies and behavioral patterns indicative of novel or zero-day threats. Through a multi-layered approach, SentinelMind enhances threat detection accuracy, reduces false positives, and automates responses, thereby empowering security analysts with actionable intelligence and freeing them from the burden of manual, repetitive tasks. This research outlines the system's architecture, methodology and discusses its potential impact on fortifying an organization's security posture in the face of an increasingly intelligent and automated threat landscape.

88. Sustainability Through Education: The Social Dimensions of Engineering Policy Frameworks

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Sustainability today is a shared human responsibility that goes beyond technology. It is based in education, guided by ethics, and shaped by policy. Engineering, a field that drives innovation and progress, must evolve from a purely technical discipline into one that values social understanding, ethical reflection, and community engagement. Education plays a key role in this change. Integrating the principles of Education for Sustainable Development (ESD) and the United Nations Sustainable Development Goals (SDGs) into engineering programs can help develop professionals who create solutions that balance progress with human and environmental well-being. This integration allows future engineers to connect innovation with empathy and technology with purpose. However, many regions still face significant gaps in inclusivity, accessibility, and value-based learning. Strengthening these areas can lead to a more holistic, human-centered approach to engineering education. This approach prepares individuals to build efficient systems while also uplifting communities and protecting the planet. By combining knowledge with compassion and ethics, sustainability becomes not just a goal, but a way of practicing engineering for the greater good.
Keywords: Sustainability, Engineering Education, Policy Frameworks, Social imension, ESD, SDGs, Ethics, Social Responsibility, Equity.

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89. Deeplearning4J on the JVM: Bridging Deep Learning Research and Enterprise Deployment

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This paper looks at DL4J, you know, that JVM-constructed framework for deep learning built for corporate applications. It shows consistent performance when applied to production use cases. DL4J is one such good open-source offering that coexists well in JVM territory. That's handy for businesses already invested in JVM infrastructure. The paper outlines DL4J's core components, including ND4J for numerical computation, the Neural Network API for defining and training models, DataVec for data preprocessing, and the Model Zoo for accessing pre-trained models. A big aspect is DL4J's interoperability with big data technologies like Apache Spark and Hadoop. That equates to distributed learning and scaling out for corporate applications. It also facilitates importing models from elsewhere and exporting them as well. The paper addresses optimizing deployment and performance in real-world systems. It gives some practical advice regarding when DL4J outperforms frameworks like TensorFlow or PyTorch—particularly if JVM interoperability is a must, enterprises require strong security, or smooth deployment pipelines are critical. There are caveats with DL4J, though, such as a smaller community compared to more mainstream frameworks. The paper suggests ways of addressing these limitations and provides best practices for introducing DL4J into enterprise AI and data workflows. Insights are drawn from official documentation, community-contributed examples, and feedback from JVM data science practitioners. Ultimately, Deeplearning4j emerges as a strong option for enterprises seeking scalable, JVM-friendly deep learning that is reliable in production environments.

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90. Organic and Nano Fertilizers: A Review of Sustainable Alternatives for Modern Agriculture

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The imperative to feed a growing global population must be reconciled with the urgent need to restore planetary health. Sustainable agriculture represents a critical framework for achieving this balance. Conventional farming, characterized by a high dependency on synthetic fertilizers, has contributed significantly to soil degradation, water resource depletion, and climate change. Organic and nano fertilizers emerge as promising innovations capable of enhancing crop productivity while improving environmental sustainability. Organic fertilizers, derived from natural substances such as compost and manure, enhance soil health by fostering a robust ecosystem of beneficial microbes. Nano fertilizers, leveraging precision nanotechnology, facilitate the targeted delivery of nutrients, thereby dramatically improving nutrient use efficiency and reducing waste. This review critically examines the mechanisms of action, comparative advantages, and current limitations of these alternative fertilizers. We conclude that their integrated application presents a transformative approach for developing more resilient and sustainable agricultural systems.

Keywords: organic fertilizers, Nano fertilizers, sustainable agriculture, soil health, nutrient use efficiency, environmental impact

91. The Engineering of Intelligence: A Synthesis of Software Engineering Principles in the Age of Artificial

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The rapid proliferation of Artificial Intelligence (AI) has precipitated a new "software crisis," distinct from its 20th-century predecessor. This contemporary challenge is not merely one of code complexity but is rooted in the inherent non-determinism, data-centricity, and multifaceted evolution of AI-enabled systems. A significant percentage of AI projects fail to transition from prototype to production, a statistic that points not to a failure of algorithmic potential but to a deficit in engineering discipline. This paper addresses this gap by synthesizing the state of the art in Software Engineering for AI (SE4AI), the critical practice of applying systematic engineering principles to build, deploy, and maintain robust, scalable, and trustworthy AI systems. It is argued that the adoption of tailored methodologies, particularly Machine Learning Operations (MLOps) as a technical backbone and comprehensive AI Governance as an ethical and strategic overlay, is imperative for overcoming the unique challenges of the AI lifecycle. This analysis further explores the symbiotic relationship with the complementary field of AI for Software Engineering (AI4SE), where AI-powered tools are increasingly leveraged to manage the complexity of AI systems themselves. This creates a powerful, mutually reinforcing loop that is being profoundly accelerated by the disruptive force of generative AI. This paper provides a holistic framework for understanding the challenges, methodologies, and future directions at the intersection of these two transformative fields, concluding that the future of scalable and responsible AI is fundamentally an engineering endeavor.

92. Using Generative AI to Teach Critical Thinking and Misinformation Detection

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The rapid expansion of generative artificial intelligence genai technologies in educational contexts presents both unprecedented opportunities and complex challenges for contemporary teaching and learning beyond their capacity to generate coherent text simulate debates and provide personalised feedback tools such as chatgpt bard and claude have the potential to serve as catalysts for developing higher order cognitive skills particularly critical thinking and misinformation detection in an era where students are increasingly exposed to vast volumes of unverified or deliberately misleading information the ability to analyse arguments evaluate sources and recognise deceptive content has become a core academic and civic competency this study investigates how genai can be purposefully integrated into higher education pedagogy to foster analytical reasoning source evaluation and digital literacy employing a mixed methods design we conducted in depth case studies at two universities administered surveys to 150 undergraduate students across diverse disciplines and carried out semi structured interviews with 12 faculty members the intervention involved structured genai based activities ranging from critiquing ai generated essays to fact checking fabricated news scenarios deliberately framed with clear learning objectives and robust ethical guidelines keywords generative "AI and Critical Thinking" misinformation detection digital literacy pedagogy higher education.

Keywords: Generative AI, critical thinking, misinformation detection, digital literacy, pedagogy, higher education.

93. Bioremediation of Soil Contaminated by Heavy Metals Using Local Microbial Consortia: An Ecological Method for Decontaminating Soil

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Heavy metal pollution in agricultural soils is a serious danger to environmental sustainability, food safety, and human health. Conventional repair methods are frequently costly, energy-intensive, and environmentally harmful. The potential of native microbial consortia for the sustainable and economical bioremediation of heavy metal-laden soils is examined in this study. Using biochemical and molecular methods, local bacterial strains that demonstrated resistance to chromium (Cr), lead (Pb), and cadmium (Cd) were identified from soil samples taken from industrially affected areas in Western Uttar Pradesh, India. A synergistic microbial consortium made up of Rhizobium, Bacillus, and Pseudomonas spp. was created and used in controlled soil microcosms. Significant reductions in heavy metal concentrations, up to 72% for Cr and 65% for Pb, as well as increases in soil pH, microbial biomass, and plant development metrics were noted in Vigna radiata test crops during a 60-day period. The findings show that native microbial consortia improve soil fertility, support sustainable agriculture, and improve metal detoxification. In addition to supporting many UN Sustainable Development Goals (SDGs), such as clean water and sanitation (SDG 6), climate action (SDG 13), and life on land (SDG 15), this eco-biotechnological approach is in line with international initiatives towards integrated ecosystem management. The results provide a scalable paradigm for soil decontamination in developing areas and highlight the potential of bioengineered microbial systems in environmental restoration.

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94. Sustainable Drugs Repurposing Strategies against MDR Pseudomonas aeruginosa

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"Antibiotic resistance has emerged as an escalating and urgent global health issue, necessitating the development of innovative and sustainable therapeutic approaches. This study examines the repurposing of established pharmaceutical chemicals as possible antimicrobial medicines targeting Pseudomonas aeruginosa, pathogenic multidrug-resistant bacteria linked to severe nosocomial infections. This research corresponds with Sustainable Development Goal SDG 3 by addressing antimicrobial resistance via resource-efficient alternatives and SDG 9 by facilitating sustainable innovation in therapeutic development. The P. aeruginosa strain MTYR07 was cultivated in a laboratory. Fifty-five pharmaceutical drugs, including both antibiotics and non-antibiotics, were chosen based on their structural characteristics, pharmacological efficacy, and potential for off-target antimicrobial interactions. Antibacterial screening was conducted to evaluate inhibitory efficacy. Numerous substances exhibited significant inhibition of bacterial proliferation, as seen by the absence of pyocyanin pigment, although various non-antibiotic agents displayed considerable inhibitory efficacy. The results indicate that drug repurposing provides a sustainable, swift, and economical approach for addressing multidrug-resistant pathogens. This approach provides a strong foundation for future advancements. This research will support the development of effective alternative therapies for Pseudomonas aeruginosa infections, offering sustainable, faster, and more resource-efficient solutions to combat multidrug-resistant pathogens.

Keywords: Drug repurposing, Pseudomonas aeruginosa, Multidrug-resistant bacteria, Antimicrobial screening, Sustainable therapeutic strategies.

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95. The Use of Big Data in Improving Customer Experience in the Indian Banking Sector

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Abstract: The Indian banking sector has led to significant digital changes in the last decade, inspired by government initiative, fintech cooperation and growing customers. Big Data Analytics provides the bank to understand customer behaviour, enable financial inclusion and provide equipment to provide safe, spontaneous and personal banking experience. This paper examines the role of large data in enhancing customer experience in Indian context, which focuses on applications such as privatization, fraud detection, UPI-powered digital services and base-capable banking. Using literature reviews, case studies and survey findings, research has been highlighted that Indian banks take advantage of large data reports high customer satisfaction, prevention of better fraud and overflow. Along with recommendations for permanent implementation in India's regulatory and socio-economic structure, challenges related to data privacy, infrastructure and digital literacy are also discussed.

Keywords: Big Data Analytics, Indian Banking, Customer Experience, UPI, Aadhaar, Fraud Detection, Digital Payments.

96. Transforming Indian Transport through Intelligent Transportation Systems its Issues and Opportunities: A Review

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We are evolved from the homo-sapiens and by evolution and its intent of willing to learn and adapt over other species evolved over time. We evolved and uses stone and wood to make the spears, arrows. Further, the transportation began with the invention of the wheels of the bull cart in ancient times to the modern: bikes, cars, trains, ships & aircraft. With respect to the increasing population, the demand of vehicles is also increasing & the automotive industry rapidly started designing, developing and manufacturing of vehicles to manage the modern transportation demand. The Indian industry produced a total of 2.84 crore vehicles of all categories in the financial year 2023-24 which is approximately 10% more than the production of vehicle in FY 2022-23 [1]. India has a huge road network of more than 63 lakh km of road network, out of which National Highways is nearly 1.46 lakh km, the state highways is nearly 1.79 km and 60.19 lakh km other roads [2]. But in current scenario this road network is still less as the road user increasing rapidly due to which transportation facility remain susceptible to congestion leading to traffic jams, road accident, inefficient in handling vehicle numbers and pollution. Hence, the role of Transforming Indian Transport through Intelligent Transportation Systems has more importance to cover the modern issues worldwide, ITS have revolutionized urban mobility via advanced traffic management, real-time information systems, and interconnected vehicle technologies but their broad implementation is yet regulatory, financial and infrastructure obstacles prevent their widespread adoption in India.

Keywords: Intelligent Transportation Systems (ITS), Smart Mobility, Traffic Management, Road Safety, Real-Time Information, Connected Vehicles, IoT in Transportation, Urban Congestion, Pollution Control, Transportation Infrastructure, Vehicle Network Technologies, India Road Network

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97. Robotic and Automation

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This paper provides a multi-disciplinary analysis of the rapidly evolving domain of Robotics and Automation (R&A), focusing on its transition from isolated industrial applications to integrated socio-technical systems. We argue that the field is defined by three interconnected transformations: technological synergy, foundational engineering mastery, and socio-geographical application. We first examine the technological synergy necessary for Industry 4.0, demonstrating that Robotic Process Automation (RPA) must be complemented by Artificial Intelligence (AI). While RPA automates rule-based processes, AI algorithms—including Natural Language Processing (NLP) and neural networks—are crucial for enhancing the accuracy and execution quality by enabling the extraction of information from complex, unstructured data. This synthesis overcomes the limitations of pure automation, driving significant efficiency gains. Next, we detail the foundational engineering principles that enable reliable autonomous action. The research validates the critical importance of Closed-Loop Control Systems operating within the robot's Embedded System. Specifically, we analyze Proportional-Derivative (PD) and Proportional-Integral-Derivative (PID) controllers. The inclusion of the Derivative (D) term is identified as essential for introducing damping and ensuring strict stability, which allows a robot to minimize the error (e(t)) between the desired and actual states, thereby achieving reliable, precise motion in real-time.

98. Turning Co_2 into Opportunity: The Future of Clean, Resilient Industry

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Industrial development has driven economic growth, but it has also led to a steady increase in carbon dioxide levels in the atmosphere. This rise is closely linked to issues like stronger heat waves, unpredictable rainfall, and increased disruption in natural climate patterns. As the need for practical climate solutions becomes more urgent, Carbon Capture and Utilization (CCU) is gaining attention for its ability to address emissions at their source. CCU captures CO_2 released from factories and power plants and converts it into useful products like fuels, chemicals, and durable construction materials. By changing carbon that would otherwise pollute the air, CCU helps reduce environmental harm while adding value to industrial processes. CCU is especially relevant today because it contributes to a circular carbon economy, where waste gases are not just emitted but reused in productive ways. This approach allows industries to keep operating while reducing their carbon footprint, making it a realistic step toward meeting national and global climate commitments. With recent advancements and several successful large-scale demonstrations, CCU has moved from concept to practical implementation. As emissions continue to rise, CCU offers a meaningful path toward cleaner, more responsible, and climate-resilient industrial growth.

Keywords: Industrial emissions, Environmental imbalance, Circular carbon economy, Sustainable pathway, Low-carbon future.

99. Differential Bio-attributes of Moringa, Curry, Neem, and Tulsi Leaves and Their Potential Impact on Ecological Biofertilizer Innovations

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The nutrient dense leaves like Moringa oleifera (Moringa), Murraya koenigii(Curry), Azadirachta indica (Neem) and Ocimum tenuiflorum (Tulsi) are of utmost importance within the ecosystem. These are known for its various biochemical properties and their potential as an eco-friendly plant-based fertilizer, narrowing the dependence on conventional methods. Exploration of phytochemical profiles highlights its role in enhancing several properties such as its essential nutrient content and phytohormones and their chemical profiles which have the propensity to mimic bio-stimulants. The main emphasis is on its pivotal role in the field of agriculture as it is one of the keys sustainable alternatives to the mainstream chemical fertilizers contributing to the enhanced nutrient availability, microbial activity of the soil microorganisms and enhanced crop yield while reducing the impact of chemical fertilizers on environment. By collating the characteristics of these plant leaves one must seek to deliver comprehensive insights that could serve as a tool for optimizing the traditional formulations of the fertilizers that could eventually play a vital role in fostering organic farming by leveraging plant-based fertilizers either by supplementing or by partially replacing conventional fertilizers.

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100. Pharmacy Students Perception Towards Clinical Practice and Experimental Learning

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Abstract: Pharmacy Students' Perception Towards Clinical Practice and Experimental Learning

Clinical practice and experimental learning play a crucial role in developing the professional competence of pharmacy students. This abstract explores the perceptions, attitudes, and experiences of pharmacy students regarding practical exposure in clinical settings and hands-on experimental laboratories. Students generally view clinical practice as an essential component for enhancing therapeutic decision-making, patient counseling skills, and real-world application of pharmacological knowledge. Experimental learning, including laboratory experiments and case-based simulations, helps strengthen conceptual understanding and develops analytical and problem-solving abilities.

However, students also report challenges such as limited clinical exposure, insufficient interaction with healthcare professionals, lack of advanced laboratory infrastructure, and inadequate time allocation for practical sessions. Despite these barriers, the majority believe that integrated clinical practice and experiential learning significantly improve their confidence, professional identity, and readiness for future pharmacy roles. Strengthening practical training, improving mentorship, and updating laboratory resources can further enhance the quality of pharmacy education.

Keywords: Pharmacy students, clinical practice, experiential learning, experimental learning, perception, pharmacy education, clinical skills, practical exposure, professional development"

101. Optimizing Pharmacotherapy in Chronic Disease Management: A Clinical Pharmacist's Role

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Optimizing pharmacotherapy in chronic disease management is a critical area where clinical pharmacists play a pivotal role. Clinical pharmacists enhance patient outcomes by conducting comprehensive medication reviews and reconciliation, which helps prevent medication errors and adverse drug events, especially during transitions of care such as hospital admission or discharge. Their expertise in pharmacokinetics and pharmacodynamics allows them to personalize medication regimens by considering patient-specific factors like age, weight, kidney and liver function, and genetic makeup, thus maximizing therapeutic efficacy and minimizing adverse effects.

In chronic diseases such as diabetes, hypertension, asthma, and inflammatory bowel disease, clinical pharmacists collaborate closely with physicians and healthcare teams to develop and adjust individualized medication plans guided by evidence-based protocols. They monitor therapeutic responses and manage medication-related side effects, supporting medication adherence through patient education and counseling.

Moreover, clinical pharmacists contribute by coordinating care, identifying potential drug interactions, reducing polypharmacy risks, and advocating for safer, more effective treatment options. They also play a key role in multidisciplinary teams, ensuring medication safety and optimizing treatment outcomes, which ultimately reduces healthcare costs and improves quality of life for patients with chronic conditions. Their involvement fosters enhanced communication among healthcare professionals and promotes shared decision-making, making clinical pharmacists indispensable in the continuum of chronic disease management.

Keywords:-
Clinical Pharmacist, Chronic Disease Management, Pharmacotherapy, Optimization Medication, Adherence, Multidisciplinary Care.

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102. Impact of Clinical Pharmacist Interventions on Patient Outcomes in Tertiary Care.

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Clinical pharmacists play a vital role in optimizing pharmacotherapy and ensuring the safe and effective use of medications. This study aims to evaluate the impact of clinical pharmacist interventions on patient outcomes in a tertiary care hospital. A prospective observational study was conducted among inpatients receiving pharmacist-led interventions, including medication review, dosage adjustments, drug interaction identification, and patient counseling. Data were collected on the type and frequency of interventions, their acceptance by physicians, and subsequent effects on patient outcomes such as medication error rates, length of hospital stay, and clinical improvement. Statistical analysis was used to determine the significance of these associations.

The results demonstrated that pharmacist interventions significantly reduced medication errors, improved therapeutic outcomes, and enhanced patient safety. Moreover, high physician acceptance rates indicated strong interprofessional collaboration. Cost savings and shorter hospital stays were additional positive outcomes observed. This study highlights the essential role of clinical pharmacists in improving the quality of patient care within tertiary care settings and underscores the importance of integrating pharmacists more effectively into multidisciplinary healthcare teams.

Keywords:-
Clinical pharmacist, interventions, patient outcomes, tertiary care, medication errors, pharmacotherapy, patient safety, healthcare quality.

103. The development of characterization of extended release tablet of drug name.

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Extended-release (ER) tablets are a pivotal advancement in oral drug delivery systems, designed to release the active pharmaceutical ingredient (API) gradually over an extended period, thereby reducing dosing frequency and enhancing patient compliance. The development process begins with the selection of suitable drug candidates and polymers— hydrophilic (e.g., HPMC) or hydrophobic (e.g., ethyl cellulose)—to achieve the desired release kinetics. Formulation techniques such as wet granulation or direct compression are employed to incorporate APIs into polymeric matrices. The powder blend is characterized for flowability, compressibility, and uniformity, while the compressed tablets are evaluated for hardness, friability, and weight variation to ensure mechanical integrity and consistency. In vitro drug release studies are conducted using USP dissolution apparatus to confirm the extended-release profile. Drug-polymer compatibility and content uniformity are assessed for batch reproducibility. Optimized formulations undergo accelerated stability studies under varying temperature and humidity to confirm formulation robustness throughout the product's shelf life. ER tablets offer improved therapeutic efficacy by minimizing plasma level fluctuations, enhancing patient adherence, and reducing the risk of side effects associated with peak doses. The systematic development and thorough characterization of ER tablets thus contribute to safe, efficient, and patient-friendly medication regimens.

Example: Metformin, Metoprolol succinate, Tramadol, Theophylline, Morphine sulfate.

Keywords: Prolong drug release, Formulation method, In vitro release study, Patient benefits.

104. Phytochemical analysis and pharmacological screening of medicinal plant

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Abstract: Phytochemical analysis and pharmacological screening of medicinal plants play a crucial role in the discovery of novel therapeutic agents from natural sources. The present study investigates the phytochemical profile and biological activities of a selected medicinal plant to validate its traditional medicinal uses. Preliminary phytochemical screening revealed the presence of major bioactive constituents such as alkaloids, flavonoids, tannins, saponins, phenols, glycosides, and terpenoids, which are known to contribute to various pharmacological activities. Extracts prepared using solvents of different polarity were evaluated for antioxidant, anti-inflammatory, antimicrobial, and analgesic activities using standard in-vitro and in-vivo models. The plant showed significant pharmacological potential, indicating the presence of therapeutically valuable compounds. These findings support the traditional use of the plant and highlight its potential for further isolation, characterization, and development of new drugs.

Key Points

Medicinal plants are rich sources of bioactive phytochemicals. Phytochemical screening detected important secondary metabolites. Extracts were tested for antioxidant, antimicrobial, anti-inflammatory, and analgesic effects.

105. To prepare tha abstract on challenge in genetic drug approval process. A regulatory perspective

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"The approval of genetic drugs—such as gene therapies, genome-editing products, and personalized genetic treatments—presents unique regulatory challenges that differ significantly from conventional pharmaceuticals. These products often involve complex biological mechanisms, individualized treatment approaches, and long-term safety considerations, requiring regulatory authorities to adapt and update existing frameworks. Major challenges include limited long-term clinical data, variability in patient-specific responses, stringent manufacturing and quality-control requirements, and the need for robust pharmacovigilance systems. Regulatory agencies such as the FDA, EMA, and CDSCO emphasize risk-based evaluation, advanced clinical trial designs, and standardized genomic testing methods to ensure product safety, efficacy, and ethical compliance. Despite advancements, gaps remain in harmonizing global regulatory standards, managing high development costs, and ensuring equitable access. Addressing these challenges is essential to accelerate innovation while maintaining public trust and ensuring patient safety in the rapidly evolving field of genetic therapeutics.

Keywords: Genetic Drugs, Gene Therapy, Regulatory Challenges, Drug Approval Process, Gene Editing, CRISPR Technology, Safety and Efficacy, Regulatory Agencies Biopharmaceutical Regulation, Post-Marketing Surveillance"

106. A Review on Anti-Epileptic Drugs: Mechanisms, Therapeutic Advances, and Clinical Perspectives

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Abstract:
Epilepsy is a chronic neurological disorder marked by recurrent, unprovoked seizures due to abnormal electrical activity in the brain. Anti-epileptic drugs (AEDs) remain the cornerstone of epilepsy management, aiming to prevent seizures by stabilizing neuronal excitability and maintaining the balance between excitatory and inhibitory neurotransmission. These agents primarily act by blocking voltage-gated sodium and calcium channels, enhancing GABA-mediated inhibition, or reducing glutamatergic excitation. Conventional AEDs such as phenytoin, carbamazepine, valproic acid, phenobarbital, and ethosuximide have long been utilized as first-line therapies. However, limitations including narrow therapeutic index, adverse drug reactions, and potential interactions have prompted the development of newer, safer alternatives. Second-generation AEDs like lamotrigine, levetiracetam, topiramate, gabapentin, oxcarbazepine, and zonisamide offer improved pharmacokinetic profiles, fewer interactions, and better tolerability. Recent innovations in pharmacotherapy focus on third-generation AEDs such as lacosamide, perampanel, and brivaracetam, which provide more targeted mechanisms and are particularly beneficial for refractory epilepsy. Personalized medicine and pharmacogenomic approaches are emerging as key strategies to optimize drug selection and dosing based on individual genetic variability and metabolic response. Despite progress, complete seizure control remains challenging in many patients. Ongoing research emphasizes developing novel molecular targets, combination therapies, and improved brain delivery systems to enhance therapeutic efficacy and minimize side effects.

Keywords: Anti-epileptic drugs, epilepsy, phenytoin, valproic acid, carbamazepine, levetiracetam, lamotrigine, topiramate, brivaracetam, pharmacotherapy, personalized medicines"

107. Duckweed as a Next-Generation Bioresource

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The integration of rapid growing aquatic plants like duckweed with modern biotechnology offers a revolutionary path for sustainable food, feed, and environmental solution. Duckweed (Lemna Minor), one of the fastest growing plant on earth. Also duckweed, known for exceptional protein content, fast biomass, accumulation and efficient nutrients up taken, is highly promising resources for animal feed, wastewater treatment and bioenergy production. Biotechnology innovations have enhanced the nutritional quality, biomass yield and stress tolerance of duckweed species, making them suitable for poultry, cattle, fish and exotic species duckweed is potentially an idea biofuel feedstock due to its high proportion of cellulose and starch and low lignin content. This article shows that, for the variety and batch evaluated, carbohydrate constitute 51.2% (w/w) of dry matter while starch accounts of 19.9%. The cell wall is rich in cellulose and also contain pectin comprising galacturonon, xylogalacturonon, rhamnogalacturonon, hemicellulose comprising xyloglucon and xylan and phenolics. In addition, essential fatty acid and p-coumaric acid respectively are the most abundant fatty acid and phenolic in whole duckweed. Chemical components found in duckweed are proteins, carbohydrates, lipids(fats), minerals like (calcium, potassium, magnesium, iron, phosphorus), vitamins, pigments, antioxidants, fiber.

Keywords: Duckweed, Aquatic plants, Animal feed, Wastewater treatment, Biofuel feedstock.

108. Did Hastinapur submerge? A Geospatial Examination of the Flood Beliefs in the Vishnu Purana

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The Vishnu Purana maintains a notable legend that a colossal flood of the Ganga ravaged the ancient city of Hastinapur. Although this tale has always been regarded as mytho-historical, current advancements in geomorphology, remote sensing, and archaeological stratigraphy enable a thorough scientific reassessment of the event. This study investigates whether an actual hydrological disturbance such as flooding, avulsion, or extensive channel migration could be the basis for the Purāṇic recollection of Hastinapur being “drowned.” We utilize multi source geospatial datasets and multi-

temporal satellite imagery, particularly from Landsat, to identify paleochannel (active channel) traces linked to the Budhi Ganga and to reconstruct Holocene River dynamics in the area. The findings indicate a well-defined abandoned channel belt, low-lying depressions, and wetlands that align with a prior path of the Ganga next to ancient Hastinapur. The correlation with archaeological data, particularly the substantial silt/clay horizon documented in the Archaeological Survey of India excavations conducted in 1951 by Dr. B.B. Lal, substantiates the occurrence of a significant flooding or avulsion event that might have buried settlement levels and led to site abandonment. The evidence does not substantiate a unique catastrophic flood, but it certainly indicates a considerable geomorphological reconfiguration of the Ganga system during the protohistoric era. In conjunction with geospatial data, the revenue records from 1951, along with earlier cadastral and survey maps from 1865, offer essential historical confirmation of the previous river flow and floodplain dynamics surrounding Hastinapur. The combination of textual traditions, palaeochannels mapping, and stratigraphic data yields a scientifically justified model explaining how an actual hydrological event might have been preserved in cultural memory as the “drowning” of Hastinapur.

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