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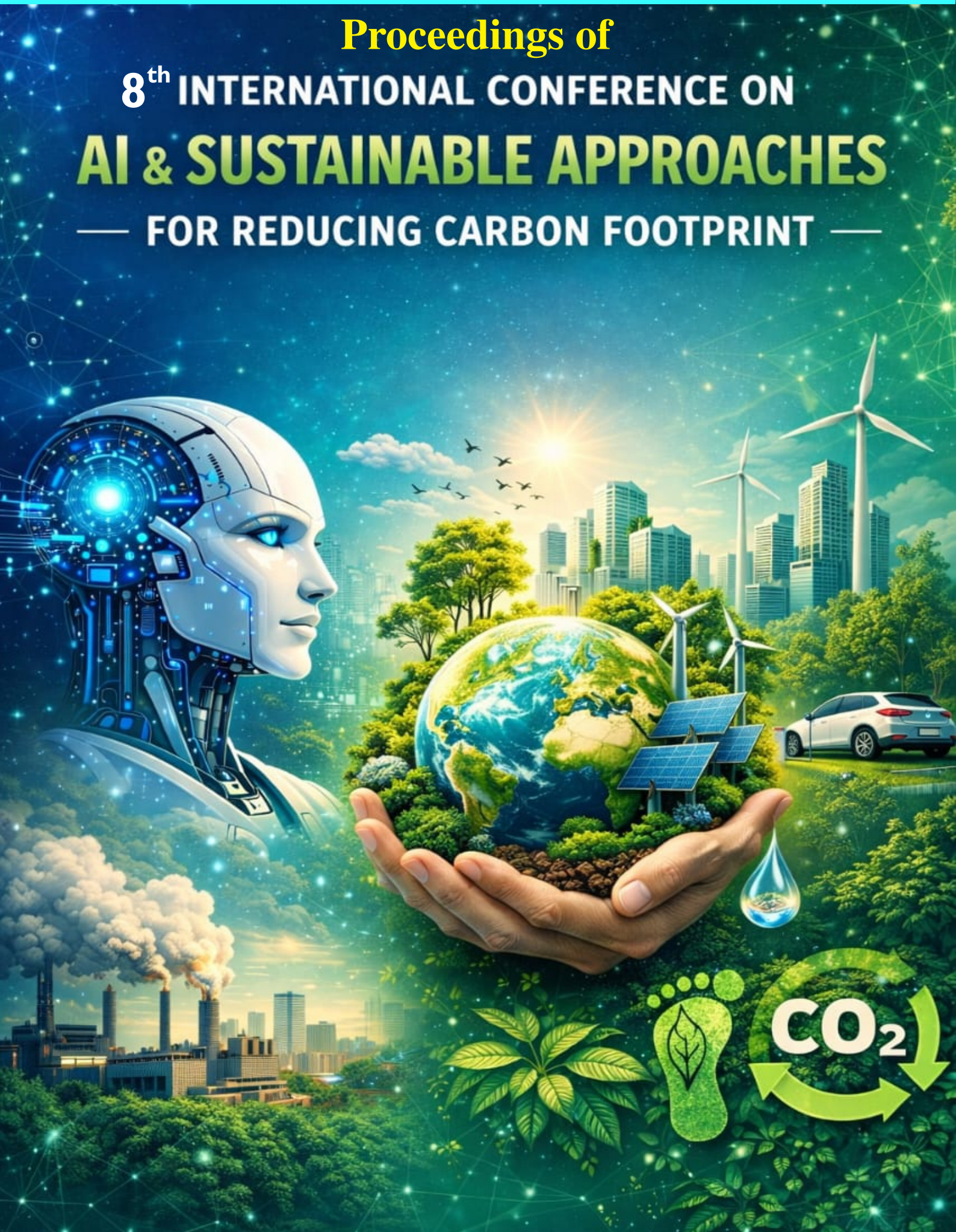
Proceedings of

8th INTERNATIONAL CONFERENCE ON

AI & SUSTAINABLE APPROACHES

— FOR REDUCING CARBON FOOTPRINT —



OUR INSPIRATION

The actual fact of life is,
"To achieve Golden path to success;
one most strive hard from dawn to dusk".
The crux behind this is,
"The hard work that you put in,
will be recognized as an appreciation by the honor of success."

SHRI MUKUT BIHARI LAL

राजश्री कुलगीत

राजश्री जग में उजियारा लाया है,
शिक्षण सेवा का एक–दीप जलाया है!

इतने ऊँचे उठो जितना उठा ये गगन है,
माँ–बापूजी ने हमको प्रण ये दिलाया है,
प्रण ये पूरा हो–मन में यही लगन है,
पिताश्री का जीवन–दर्शन अपनाया है,
शिक्षण सेवा का गण–दीप जलाया है,
राजश्री जग में उजियारा लाया है!

छात्र–छात्राओं ने यहाँ पढ़–लिखकर,
गुरु–शिष्य परंपरा का मान बढ़ाया है,
चिकित्सा, सम्मान, उपाधि, ज्ञान लेकर,
राजश्री में जीवन–सुमन खिलाया है,
शिक्षण सेवा का वट–वृक्ष लगाया है,
राजश्री जग में उजियारा लाया है!

लेकर हम ज्ञान और विज्ञान की वन्दनवार,
करते हम ईश की वंदना यह बारम्बार–
तमसो मा ज्योतिर्गमय हित–हो आलोकिक,
ज्ञान–ज्योति का इस भूतल पर दीप जले देखो बारम्बार
शिक्षण सेवा का मन में दीप जलाया है,
राजश्री जग में उजियारा लाया है!

-डॉ.मोनिका अग्रवाल
(वाइस चेयरपर्सन)
राजश्री ग्रुप ऑफ इंस्टीट्यूशन्स, बरेली

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March 13-14, 2026

International Conference on AI & Sustainable Approaches for Reducing Carbon Footprint

ICAI-SACF 2026

About Rajshree Group of Institutions, Bareilly (U.P.) India

The Rajshree Group is a diversified conglomerate with interests spanning across various industries. With a strong commitment to innovation, quality, and sustainability, the group has established itself as a leading player in multiple sectors driven by the visionary leadership of Chairman Shri Rajendra Kumar Agarwal and Secretary Shri Rakesh Kumar Agarwal. The group has broadened its horizons across various sectors, including education, manufacturing, infrastructure development, real estate, agriculture, healthcare, and social development on a robust foundation of ethical and social values. Rajshree Group made a significant leap into the educational field by establishing the Rajshree Institute of Management & Technology in 2009.Today, it is ISO 9001:2015 certified Institute and has carved a niche for itself having been ranked consistently among the top institutes of the country. Presently Rajshree Group is running 12 prestigious educational Institutions in Bareilly and oFFering an array of 98+ programmes in different disciplines including Engineering, Medical, Management, Education, Science, Arts, Commerce, Pharmacy, Law, Nursing, Polytechnic, Diploma, ITI, Ayurvedic, etc. Rajshree Group is also pioneering in providing state-of-art health care facilities, delivering outstanding patient care and advancing the well-being of the people through 1050 bedded multi super speciality Hospital at Rampur Road, 650 bedded Hospital and 60 bedded Ayurvedic Hospital at Pilibhit Road.

About Bundelkhand Institute of Engineering & Technology (BIT) Jhansi

Bundelkhand Institute of Engineering & Technology, Jhansi has proved to be the most preferred destination for aspiring technologists across the country. The institute consistently attracts the finest faculty and the best of students for its Bachelor's and Master's programmes. B.I.E.T has a rich tradition of pursuing excellence and has continually re-invented itself in terms of academic programmes and research infrastructure. Students are exposed to challenging research based academics and a host of sport, cultural and organizational activities on its vibrant campus. The presence of world class facilities, vigorous institute-industry collaboration programmes, interdisciplinary research collaborations and industrial training opportunities help students of B.I.E.T to excel and be ahead in the competitive professional environment. In the last twenty years, B.I.E.T has produced many illustrious professionals, whose contributions at national and international levels have been significant.

University of Ilorin, Nigeria

The University of Ilorin (Unilorin), established in 1975, is a leading Nigerian institution known for academic excellence, stable academic calendar, and commitment to research, innovation, and character development. The vision of the university is to be an international centre of excellence in learning, research, probity, and service to humanity. In pursuit of this vision, its mission is to provide a world-class environment for learning, research and community service. These aspirations are firmly grounded in its core values, which emphasize Integrity, Networking, Justice, Excellence, Compassion and Teamwork (INJECT) as guiding principles for all academic and institutional endeavors. The University is dedicated to imparting knowledge and 21st century skills such as critical thinking and problem solving skills making its students to be invaluable assets to the world. It is committed to excellence in teaching, learning, research, innovation and community service creating leaders who make positive difference across the world.

Lumbini Technological University (LTU), Nepal

Lumbini Technological University (LTU) was established in Nepal with the goal of advancing higher education in the field of information technology, engineering, agricultural and forestry, and tourism, among others, with a particular focus on the application and development of technology and innovation. LTU's mission is to promote and offer comprehensive programs at undergraduate and graduate levels that produce graduates who have both disciplinary expertise and the ability to handle real-world problems by combining theoretical knowledge with practical application along with exposure visits to reputed technological institutions. LTU recognizes that academic programs are not the only way to foster a rich learning experience. It also places a strong emphasis on research and continuous education programs by supporting and encouraging students and faculty to engage in rigorous research activities, thus fostering a culture of innovation and creativity that benefits both students and faculty members.

Reformed Church University (RCU), Zimbabwe

Reformed Church University (RCU) is a higher education institution located in Masvingo, Zimbabwe. Established in 2012, RCU was founded by the Reformed Church in Zimbabwe following the granting of a charter by the Zimbabwe Council for Higher Education in 2010. The university officially commenced operations on August 12, 2012, with the support of the church and the accreditation of its initial degree programs. RCU aims to be a world-class center of excellence in special needs education, technology, and community service. The university emphasizes inclusivity, striving to provide educational opportunities for individuals with and without disabilities. RCU provides a range of academic programs with a strong emphasis on special needs education, technology, and community service. The university seeks to provide inclusive education that accommodates students of diverse needs.

International Conference on "AI & Sustainable Approaches for Reducing Carbon Footprint" (ICAI-SACF 2026)

Rajshree Institute of Management and Technology, Bareilly (U.P.), India, is organizing a two-day International Conference on "AI & Sustainable Approaches for Reducing Carbon Footprint" on March 13–14, 2026, in collaboration with international partner universities. The conference will be conducted in hybrid mode at the Rajshree Group campus. The theme of the conference focuses on examining how artificial intelligence can be effectively integrated with sustainable practices to reduce carbon emissions, optimize resource efficiency, and support environmentally responsible development across various sectors. The aim of the conference is to bring together academicians, researchers, policymakers, industry leaders, and students to explore how artificial intelligence can become a powerful driver of climate action and sustainable development. The conference emphasizes practical and policy-oriented applications of AI in areas such as smart energy management, green infrastructure, sustainable campuses, renewable energy integration, waste reduction, and intelligent resource optimization. Beyond technology, it highlights the importance of education, institutional leadership, and behavioral change in achieving long-term environmental impact. By encouraging interdisciplinary dialogue, sharing best practices, and aligning innovation with global frameworks such as the United Nations Sustainable Development Goals, the conference seeks to inspire collective action toward carbon neutrality and a more sustainable future.

Conference Theme

The International Conference on "AI & Sustainable Approaches for Reducing Carbon Footprint" invites original research papers, case studies, conceptual papers, and review articles across the following interdisciplinary tracks including but not limited to the following disciplines. The tracks are designed to encourage scholarly dialogue on the integration of artificial intelligence with sustainability-driven practices across diverse academic and professional domains.

Engineering

- AI in Smart Manufacturing & Industry 4.0
- AI-based Energy-EFFICIENT Systems
- Intelligent Transportation & Smart Mobility
- AI for Renewable Energy Integration
- Smart Grids & Carbon-Neutral Infrastructure
- AI-enabled Waste Management & Circular Economy

Management

- AI-Driven Sustainable Business Models
- Green Supply Chain & Logistics Optimization
- AI for ESG, Carbon Accounting & Reporting
- Sustainable Operations & Decision Analytics
- AI in Smart Cities & Urban Sustainability

Science

- AI in Climate Modeling & Environmental Forecasting
- Data Science for Carbon Emission Analysis
- AI-Enabled Material Science for Sustainability
- Computational Sustainability & Green Chemistry
- AI in Biodiversity & Ecosystem Monitoring

Medical Sciences

- AI-Enabled Green Healthcare Systems
- Sustainable Hospital Management using AI
- AI in Telemedicine & Carbon Reduction in Healthcare
- Smart Medical Devices for Energy Utilization
- AI-Based Healthcare Resource Optimization

Law

- AI in Environmental Law & Policy Making
- Legal Frameworks for AI & Sustainability
- AI-Assisted Climate Risk Assessment & Compliance
- Tech-Driven Enforcement of Environmental Regulation
- Ethics, Governance & AI for Sustainable Development

Pharmacy

- AI in Green Drug Discovery & Development
- Sustainable Pharmaceutical Manufacturing using AI
- AI for Waste Reduction & Energy EFFICIENCY in Pharma
- Predictive Analytics for Eco-friendly Formulations
- AI in Supply Chain Sustainability in Pharmaceuticals

Ayurveda

- AI for Digitization & Standardization of Ayurvedic Knowledge
- Sustainable Cultivation & Conservation of Medicinal Plants using AI
- AI-Driven Personalized Ayurveda
- Carbon-Neutral Ayurvedic Manufacturing Practices
- AI in Herbal Drug Quality Assessment

Nursing

- AI-Based Sustainable Healthcare Practices
- Smart Patient Care Systems for Resource Optimization
- AI in Community Health & Environmental Awareness
- Green Nursing Practices Enabled by AI
- AI-Supported Public Health Monitoring

Other / Interdisciplinary Tracks

- AI & Sustainability in Agriculture and Agri-Tech
- AI for Smart Cities & Urban Planning
- AI in Education for Sustainable Development
- AI for Water Resource Management & Jal Sustainability
- AI in Disaster Prediction, Climate Resilience & Risk Reduction
- AI for Carbon Capture, Storage & Utilization (CCUS)
- AI in Transportation, EVs & Sustainable Mobility
- AI for Circular Economy & Zero-Waste Technologies
- AI in Environmental Monitoring using Drones & Remote Sensing
- AI for Policy Planning, SDGs & Climate Action
- AI & Green Finance / FinTech for Sustainability
- AI in Startups, Innovation & Sustainable Entrepreneurship

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Message

It gives me immense pleasure to learn that Rajshree Institute of Management and Technology, Bareilly is organizing a two-day International Conference on "AI & Sustainable Approaches for Reducing Carbon Footprint" on 13th–14th March, 2026, in collaboration with international partner universities.

It is a matter of great satisfaction that the theme of the conference is both timely and relevant. In today's era, Artificial Intelligence (AI) has emerged as a powerful tool with significant potential to contribute to sustainable development. When applied responsibly, AI can help optimize resources, enhance energy efficiency, and support innovative solutions aimed at reducing carbon footprints and promoting environmental stewardship.

Such academic platforms play a vital role in fostering meaningful dialogue among scholars, researchers, students, and industry leaders. They encourage the exchange of ideas, promote collaborative research, and inspire practical solutions to contemporary environmental challenges.

I am confident that this conference will generate insightful discussions and actionable outcomes, enriching both academic inquiry and practical application.

I extend my best wishes to the organizers, participants, and collaborating institutions for the grand success of this international conference.

(Santosh Kumar Gangwar)

प्रो0 जय प्रकाश पाण्डेय
कुलपति
Prof. Jai Prakash Pandey
Vice Chancellor

डॉ0 ए0पी0जे0 अब्दुल कलाम प्राविधिक विश्वविद्यालय
उत्तर प्रदेश, लखनऊ
Dr. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY
Uttar Pradesh, Lucknow

Dated : 24.02.2026

MESSAGE

MESSAGE

I am pleased to know that Rajshree Institute of Management & Technology, Bareilly is organizing a two-day International Conference on **"AI & Sustainable Approaches for Reducing Carbon Footprint"** on March 13-14, 2026 in collaboration with international partner universities. The conference will be conducted in hybrid mode at the Rajshree Group campus. I am pleased to write this message which will be published in souvenir of the conference.

The topics to be covered in this International Conference are comprehensive and will be adequate for developing and understanding about new developments and emerging trends in this area. I hope the goal of the conference is to update the knowledge of teachers, young researchers, research scholars and PG students. I shall be glad to receive a path forward drawn from this conference.

I congratulate the organizers for taking this initiative and extend my best wishes for the successful conduction of event.

(Prof. Jai Prakash Pandey)
Vice Chancellor

Sector-11, Jankipuram Extension, Lucknow - 226031 (U.P.) India, Website : www.aktu.ac.in
(Office) : +91 522 2772189, 2772194 E-mail : vc@aktu.ac.in

ICAI-SACF

II Salutation To The Triple Gem II

LUMBINI BUDDHIST UNIVERSITY

CENTRAL OFFICE

Lumbini, Nepal

Ref No.

Date :

12/23/2025

BEST WISHES MESSAGE

I am pleased to extend my warm greetings and best wishes to the organizers, collaborators, and participants of the two-day International Conference on **"AI & Sustainable Approaches for Reducing Carbon Footprint"**, being organized by the **Rajshree Group of Institutions, Bareilly**, India, on **13–14 March 2026**.

In the contemporary global context, the convergence of artificial intelligence and sustainability has become critically important for addressing climate change and promoting environmentally responsible development. This conference, by bringing together academicians, researchers, industry professionals, and students from across the world, provides a timely and meaningful platform for dialogue, innovation, and collaborative solutions aimed at reducing carbon footprints through advanced technologies and sustainable practices.

Lumbini Buddhist University firmly believes in the integration of ethical wisdom, scientific knowledge, and technological advancement for the welfare of humanity and the planet. Initiatives such as this international conference significantly contribute to knowledge exchange, interdisciplinary research, and global cooperation for sustainable futures.

I commend the Rajshree Group of Institutions and its international partner universities for this valuable academic endeavor and wish the conference every success. May the deliberations, research outcomes, and collaborations emerging from this forum contribute meaningfully to global sustainability goals and inspire future generations of scholars and practitioners.

With best wishes for a successful and impactful conference.

Prof. Dr. Subarna Lal Bajracharya
Vice Chancellor

Prof. K. P. Singh
Vice-Chancellor

MAHATMA JYOTIBA PHULE ROHILKHAND UNIVERSITY
Bareilly (U.P.) - 243 006, INDIA
(NAAC A++ Accredited, UGC Category-I University)

Message

It gives me immense pleasure to know that Rajshree Institute of Management and Technology, Bareilly is organizing a Two-Day International Conference on "AI & Sustainable Approaches for Reducing Carbon Footprint" on March 13–14, 2026, in collaboration with international partner universities.

In the present era, Artificial Intelligence and sustainable development have emerged as powerful tools to address global environmental challenges. The integration of innovative technologies with sustainable practices is essential for reducing carbon emissions and promoting responsible growth. Such academic platforms play a vital role in encouraging meaningful dialogue, knowledge exchange and collaborative research among academicians, researchers, industry professionals and students across the world.

I am confident that this international conference will provide an excellent opportunity for participants to share their insights, explore innovative solutions and contribute towards building a greener and more sustainable future.

I wish the conference grand success.

(K.P.Singh)

www.mjpru.ac.in vc@mjpru.ac.in, vcoffice@mjpru.ac.in

MESSAGE

लुम्बिनी प्राविधिक विश्वविद्यालय

Lumbini Technological University

The chairman of Rajshree Group of Institution, Bareilly, Vice-Chancellors of different universities across the world, Distinguished guests, academicians, researchers, industry experts, paper presenters, participants and organizer team of this **International Conference on "AI & Sustainable Approaches for Reducing Carbon Footprint-2026 AD".**

Namaskar!

On behalf of **Lumbini Technological University, Nepal**, it is my great honor and privilege to extend warm greetings and heartfelt congratulations to the organizers of the **International Conference on "AI & Sustainable Approaches for Reducing Carbon Footprint."**

I would like to express my sincere appreciation to **Rajshree Group of Institutions, Bareilly, India**, for planning such an important and pertinent academic event that unites scholars, inventors, and intellectual leaders from all over the world. One of the biggest problems facing humanity today is climate change and the growing carbon footprint that jeopardizes the sustainability of the ecosystem. In this regard, combining artificial intelligence with sustainable development approaches has enormous potential to change how we manage energy, maximize resources, and create more intelligent and environmentally friendly communities.

Artificial Intelligence is no longer just a technological innovation; it has become a powerful catalyst for sustainable transformation. From intelligent energy management and climate prediction to smart urban planning and green supply chains, AI-driven solutions can significantly contribute to reducing global carbon emissions while ensuring efficient and responsible development. This international conference provides a distinguished platform for academicians, scientists, policymakers, and industry professionals to exchange ideas, present innovative research, and collaboratively explore technological solutions that address environmental challenges. Such interdisciplinary dialogue is essential for bridging the gap between technological advancement and sustainable development.

I firmly believe that the discussions, research presentations, and collaborative engagements during this conference will generate valuable insights and inspire innovative solutions that contribute meaningfully to global sustainability efforts. Once again, I congratulate **Rajshree Group of Institutions** for their remarkable initiative and dedication in organizing this conference. I extend my best wishes for the grand success of this academic gathering and hope that the outcomes of this conference will lead to impactful research collaborations and sustainable innovations.

Lumbini Technological University is eager to collaborate closely in the future for research, innovation, and academic achievement.

Thank you, and best wishes for a successful and fruitful conference!

Assoc. Prof. Reg Bahadur Bhandari
Registrar, Lumbini Technological Univesity
Nepalgunj-10, Banke, Lumbini Province, Nepal

लुम्बिनी प्राविधिकविश्वविद्यालय
उपकुलपतिको कार्यालय
LUMBINI TECHNOLOGICAL UNIVERSITY
Office of the Vice Chancellor
९७७८१-५३९६०१
+97781-539601
Central office: Nepalgunj, Banke, Nepal

MESSAGE

Date:March 9, 2026

I would like to extend my heartfelt best wishes toRajshree Institute of Management Technology, Bareilly, for organizing this International Conference titled **"AI & Sustainable Approaches for Reducing Carbon Footprint,"**.

At a time when the world is rapidly facing challenges such as climate change, environmental imbalance, and increasing carbon emissions, exploring ways to reduce the carbon footprint through the use of**Artificial Intelligence (AI)** and sustainable technologies is highly relevant and important. I believe that this conference, which brings together experts, researchers, and members of the academic community from around the world, will provide an excellent platform for exchanging knowledge, experiences, and research findings, and for highlighting new ideas, technologies, and solutions.

In particular, this conference is expected to make a significant contribution toward achieving the goals of sustainable development by promoting collaboration and shared learning among universities, research institutions, and industry. I am confident that the research papers and ideas included in these **Conference Proceedings** will further strengthen future efforts in policy formulation, technological innovation, and environmental conservation.

I would like to sincerely thank the organizing team for successfully arranging this important conference and wish it great success. I also hope that this conference will inspire efforts toward building a greener, cleaner, and more sustainable future for the world.

Thank you.

Prof. Binod PrasadDhakal, Ph.D.
Vice Chancellor
Lumbini Technological University
Nepalgunj, Banke, NEPAL

Rajshree
GROUP OF INSTITUTIONS
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Rajendra Kumar Agarwal
Chairman
Rajshree Group of Institutions
Bareilly (U.P.) India

It gives me immense pleasure to extend a warm welcome to all distinguished delegates, academicians, researchers, and industry professionals to the International Conference on AI & Sustainable Approaches for Reducing Carbon Footprint, organized by Rajshree Group of Institutions, Bareilly (U.P.), India on March 13-14, 2026 in hybrid mode at the Rajshree Institute campus.

This conference is a significant step towards fostering dialogue and collaboration on two of the most important concerns of our time: advancements in Artificial Intelligence and the urgent need for sustainable practices to mitigate climate change. By bringing together thought leaders from across the globe, we aim to create a platform for knowledge exchange, innovative research, and practical strategies that can contribute to reducing the carbon footprint and ensuring a greener future.At Rajshree Group of Institutions, we firmly believe that education and research must align with global priorities. This conference reflects our commitment to promoting interdisciplinary approaches, encouraging young minds, and supporting impactful solutions that blend technology with sustainability.

I sincerely thank all contributors, keynote speakers, and participants for their valuable involvement. I am confident that the deliberations and outcomes of this conference will inspire new pathways for academic excellence and societal benefit.On behalf of the Rajshree Group of Institutions, I wish the conference great success and look forward to fruitful discussions and collaborations.

MESSAGE

Rakesh Kumar Agarwal
Secretary
Rajshree Group of Institutions
Bareilly (U.P.) India

It is with great pride, we welcome all participants to the International Conference on AI & Sustainable Approaches for Reducing Carbon Footprint, organized by Rajshree Group of Institutions, Bareilly (U.P.), India on March 13–14, 2026 in hybrid mode at the Rajshree Institute campus.This conference is a testament to our institution's commitment to fostering innovation, sustainability, and global collaboration. The integration of Artificial Intelligence with sustainable practices offers immense potential to address one of humanity's greatest challenges, reducing carbon emissions and safeguarding our environment for future generations.

The conference brings together eminent scholars, researchers, and practitioners from diverse disciplines, creating a vibrant platform for exchanging ideas, sharing research, and exploring practical solutions. We are confident that the deliberations will inspire new perspectives and strengthen the collective resolve to build a greener and more sustainable world.

I extend my heartfelt gratitude to all contributors, organizing committee members, and participants whose dedication has made this conference possible. May the discussions and outcomes of this gathering pave the way for impactful innovations and meaningful collaborations.

Prof. BadarAlam Iqbal
M.Com, DBA, DSW, Ph.D.
Non-Resident Distinguished Fellow

Turkish Center for Asia-Pacific Studies (APAC)
Asya-Pasifik Araştırmaları MerkeziBasiat Institute
Akpınar Mh 854 Sk No: 10/22 Çankaya 06460
ANKARA TURKEY
email:badar.iqbal@fulbrightmail.org

December 18, 2025

Dr. Raveesh Agarwal
(Convener- AI & SARCF 2026)
Professor and Head
Department of Business Administration
Rajshree Institute of Management & Technology
Bareilly, U.P., India

Message for the Conference

Dear Prof. Dr. Agarwal,

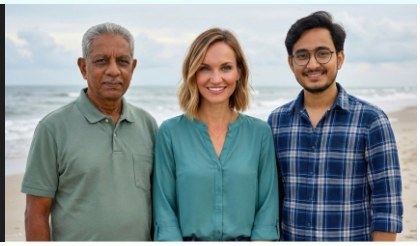
I am very happy to learn that your institute is going to organize **two days International Conference on "AI & Sustainable Approaches for Reducing Carbon Footprint"** on **March 13–14, 2026**.

The topic selected for upcoming conference is of great academic and professional value. The present 21st Century is the Century of AI and Sustainable Approaches. Your efforts will provide enormous opportunities to the participants to share their respective views on such a vital and relevant topic.

I do hope the conclusions and recommendations will be a value addition and serve a great cause for the country's expansion and development.

I wish you and the conference a great success.

Prof. Dr. Badar Alam Iqbal
Non-resident Distinguished Fellow
Asia Pacific Center, Ankara [Turkey]
Email IDs: apac@asianpacificcenter.org
asiapacificcenter@gmail.com



GDG Brunswick Leadership Team: Ramanathan Sivakumar, Naomi Latini Wolfe, and Ajay Singh Karayat

GDG Brunswick

Brunswick, GA, USA

Message of Support

On behalf of the leadership and community members of Google Developer Group (GDG) Brunswick, we extend our sincere congratulations to the Rajshree Institute of Management & Technology for organizing the 8th International Conference on AI & Sustainable Approaches for Reducing Carbon Footprint (ICAI-SACF 2026). We applaud your commitment to exploring how AI can serve as a catalyst for environmental stewardship and global climate action. We wish all participants an

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Organizational Profile: GDG Brunswick

GDG Brunswick is a community-driven hub for technology and innovation located on the Georgia coast. Our mission is to empower local developers and citizens to use emerging technologies, particularly Artificial intelligence, to address environmental sustainability and community resilience.

Leadership Team:

- Naomi Latini Wolfe, Ed.D.(c): Founder & Organizer
- Ajay Singh Karayat: Co-organizer
- Ramanathan Sivakumar: Knowledge Sharing Lead

Key Sustainability & AI Initiatives:

- **The Waterlyst Project:** An initiative focused on using technology to address local water resource management and conservation challenges.
- **Digital Declutter & Sustainability:** Workshops focused on the environmental impact of digital storage, teaching community members how to reduce their personal carbon footprints through better data management.
- **Data Center Community Impact:** Leading discussions on the intersection of large-scale tech infrastructure and local environmental health, specifically exploring sustainable ways to integrate data centers into communities.
- **Birds, Bytes & Beaches:** A "Build with AI" pop-up event held in conjunction with the Great Backyard Bird Count to assist in bird identification and citizen science data collection.

Sincerely,

Naomi Latini Wolfe

GDG Brunswick Founder & Organizer

MESSAGE

Mar 3, 2026,

Dear Prof. Agarwal,

Thank you very much for your kind invitation and for thinking of TU Berlin in connection with your upcoming international conference.

We truly appreciate the opportunity and feel honored by your thoughtful request.

The conference theme is both timely and important, and we commend you and your team for organizing such a meaningful event that brings together diverse perspectives on AI and sustainability.

We wish you every success for the conference and hope it will be an inspiring and impactful gathering for all participants.

With kind regards,

JulianeKofer

On behalf of the Vice President for Digitalization and Sustainability

--
Dr. JulianeKofer
(sie/ihr – she/her)
PersönlicheReferentin der VizepräsidentinfürDigitalisierung und Nachhaltigkeit
Personal Assistant to the Vice President for Digitalization and Sustainability
TechnischeUniversität Berlin
Straße des 17.Juni 135, 10623 Berlin

ICAI-SACF

पोखरा विश्वविद्यालय
POKHARA UNIVERSITY
Kaski, Nepal

चलानी नं.:/Ref. No.

Dr. Deepanjal Shrestha
Executive Director (International Relations Center)
Associate Professor of Computer Science
Pokhara University, Nepal

MESSAGE

Dear Esteemed Members of the Conference, Honored Scholars, and Delegates

It is both an honor and a privilege to extend my heartfelt greetings and unwavering professional support to the Rajshree Group of Institutions, Bareilly, and the Organizing Committee on the occasion of the International Conference on ***"AI & Sustainable Approaches for Reducing Carbon Footprint" (AI & SARCF 2026).***

As we confront the profound challenges of the 21st century, Computer Science has transcended its traditional role as a tool of efficiency to become a cornerstone of humanity's collective survival. The integration of Artificial Intelligence—through predictive modeling, intelligent resource optimization, and the advancement of green computing—has moved beyond choice; it is now the most powerful instrument at our disposal to meaningfully reduce the global carbon footprint.

The convergence of AI and sustainability marks a transformative frontier where innovation meets responsibility, and technology aligns with ethics. I am confident that this conference will ignite rigorous academic dialogue, foster pioneering research, and inspire algorithmic frameworks that place the health of our planet at the very center of progress.

As a proud member of the International Advisory Board, I eagerly anticipate the groundbreaking scholarship and visionary contributions that will emerge from this forum. I extend my best wishes to the organizing committee, the distinguished speakers, and all participants for a profoundly successful, intellectually enriching, and globally impactful conference.

Thank you!

Best Regards

P.O. Box: 427, Pokhara Metropolitan City-30, Lekhnath, Kaski, Nepal. E-mail:info@pu.edu.np
URL: https://pu.edu.np, Tel.:+977-61-504046/504039

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

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Zimbabwe
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FACULTY OF APPLIED SCIENCE
COMPUTER SCIENCE DEPARTMENT

Dear Sir/Madam,

Best wishes for a successful conference in **"AI & Sustainable Approaches for Reducing Carbon Footprint."** May this conference inspire impactful ideas, foster meaningful partnerships, and drive responsible AI innovations that contribute to a greener and more sustainable future.

Kind Regards,

Dr Samkeliso Suku Dube
Senior Lecturer in Computer Science
Departmental Industrial Liaison Officer
Coordinator Student Innovation Projects
Facilitator Departmental Community Service
National University of Science and Technology
Bulawayo, Zimbabwe

Email: samkeliso.dube@nust.ac.zw
WhatsApp cell no: +263 782105021

Universidad La Salle Bajío

09 March, 2026

To the Organizing Committee
Two-Day International Conference on
"AI & Sustainable Approaches for Reducing Carbon Footprint"
Rajshree Institute of Management and Technology
Bareilly (U.P.), India
March 13–14, 2026

It is my great honor and privilege to extend my warmest congratulations and best wishes to the Rajshree Institute of Management and Technology, Bareilly (U.P.), India, for the successful organization of the Two-Day International Conference on "AI & Sustainable Approaches for Reducing Carbon Footprint," held on March 13–14, 2026.

This important academic gathering represents a significant contribution to the global dialogue on sustainability, technological innovation, and environmental responsibility. The theme of the conference reflects a timely and critical commitment to exploring how Artificial Intelligence can contribute to sustainable development and to the reduction of carbon footprints through advanced analytical tools, innovative governance mechanisms, and interdisciplinary collaboration.

I commend the Rajshree Institute of Management and Technology and the Rajshree Group of Institutions for their leadership in bringing together distinguished academicians, researchers, policymakers, industry leaders, and sustainability advocates from across the world. The hybrid format of the conference demonstrates a forward-looking approach that enables global knowledge exchange and inclusive participation.

I also recognize the valuable collaboration with esteemed international partner universities whose academic engagement enriches the intellectual scope and impact of this conference. Such collaborative initiatives are essential for fostering innovative solutions to complex environmental challenges facing our planet today.

I sincerely hope that the deliberations, research presentations, and scholarly interactions during this conference will generate new insights, strengthen international academic cooperation, and inspire practical strategies for sustainable development and carbon footprint reduction.

Please accept my heartfelt congratulations for this remarkable initiative and my best wishes for a highly successful conference and continued achievements in advancing knowledge, sustainability, and global academic collaboration.

With highest consideration and academic respect,

José G. Vargas-Hernández
Full-Time Research Professor
Organizational Economics and Sustainable Green Energy Finance.
Business School, Universidad La Salle Bajío, Mexico.

MESSAGE

Rajshree
GROUP OF INSTITUTIONS
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Dr. Monika Agarwal
Vice Chairperson
Rajshree Group of Institutions
Bareilly (U.P.) India

It is indeed a privilege for Rajshree Group of Institutions to host the International Conference on AI & Sustainable Approaches for Reducing Carbon Footprint on March 13–14, 2026, in hybrid mode at our campus. We extend a cordial welcome to all distinguished delegates, scholars, and professionals joining us for this significant academic gathering.

This conference embodies our vision of blending technological innovation with environmental responsibility. Artificial Intelligence, when harnessed thoughtfully, has the potential to revolutionize industries, optimize resources, and accelerate the transition toward sustainable practices. By focusing on reducing the carbon footprint, we are not only addressing a scientific challenge but also fulfilling a moral obligation to safeguard our planet.

I am pleased that this conference will serve as a forum where perspectives from academia, research, and industry converge. Such interdisciplinary engagement is essential for producing meaningful outcomes and nurturing future leaders committed to advancing solutions that harmonize technological progress with environmental sustainability.

I extend my heartfelt appreciation to the organizing committee, contributors, and participants for their dedication and commitment. May this conference serve as a beacon of knowledge, innovation, and sustainability for years to come.

ICAI-SACF

Rajshree
GROUP OF INSTITUTIONS
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MESSAGE

Er. Tulika Agarwal
Academic Advisor
Rajshree Group of Institutions
Bareilly (U.P.) India

Knowledge attains its true value when it guides humanity toward responsible progress. In an era marked by rapid technological advancement and pressing environmental concerns, academia carries the profound responsibility of shaping ideas that harmonize innovation with sustainability. Universities and academic institutions today stand at a critical intersection where knowledge creation must directly respond to the challenges facing humanity. Among these challenges, climate change and the growing global carbon footprint demand thoughtful research, responsible innovation, and collaborative academic dialogue. In this context, I am delighted that Rajshree Group of Institutions, Bareilly (U.P.), India is organizing a two-day International Conference on "AI & Sustainable Approaches for Reducing Carbon Footprint" on March 13–14, 2026, at the Rajshree Institute campus.

From an academic perspective, such scholarly gatherings play an essential role in guiding research directions and strengthening the intellectual ecosystem of higher education. Artificial Intelligence, when aligned with sustainable thinking, offers remarkable possibilities for optimizing resources, improving environmental monitoring, and developing intelligent solutions that support long-term ecological balance.This conference represents more than a platform for presenting research papers; it symbolizes a collective academic effort to bridge technological innovation with environmental responsibility. The contributions included in these proceedings reflect the growing commitment of scholars and researchers to explore interdisciplinary solutions that integrate AI capabilities with sustainability goals.

I am confident that the deliberations, research insights, and academic interactions emerging from this conference will encourage new perspectives, inspire young scholars, and contribute to meaningful research collaborations in the evolving field of AI-driven sustainability.I sincerely appreciate the efforts of the organizing committee, reviewers, and contributors whose dedication has made this academic initiative possible. I extend my best wishes to all participants for a stimulating and successful conference.

Rajshree
GROUP OF INSTITUTIONS
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Er. Rohan Bansal
Managing Director
Rajshree Group of Institutions
Bareilly (U.P.) India

It gives me immense pleasure to share that RajshreeGroup of Institutions, Bareilly is organizing a two-day International Conference on “AI & Sustainable Approaches for Reducing Carbon Footprint”at the Rajshree Institute campus.

This international conference aims to provide a dynamic platform for academicians, researchers, industry experts, policymakers, and studentsfrom across the world to exchange ideas, share research findings, and explore innovative approaches that leverage AI for environmental sustainability and carbon footprint reduction. The conference will facilitate meaningful discussions on emerging technologies, sustainable development practices, and collaborative strategies that can help shape a greener future.I firmly believe that such academic engagements play a vital role in promoting interdisciplinary research, knowledge sharing, and global cooperation. I sincerely hope that the deliberations and research contributions presented in this conference will generate valuable insights and inspire actionable solutions for sustainable development.

I extend my heartfelt appreciation to all the members for their work and enthusiastic participation. I wish the conference great success and hope it becomes a significant milestone in advancing research and dialogue on AI-driven sustainability.
With best wishes for the success of the conference.

MESSAGE

Rajshree
GROUP OF INSTITUTIONS
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Er. Rishabh Bansal
Chief Operating Officer
Rajshree Group of Institutions
Bareilly (U.P.) India

It gives me immense pride to welcome all participants to the International Conference on AI & Sustainable Approaches for Reducing Carbon Footprint, organized by Rajshree Group of Institutions at our campus.

Academic institutions hold a vital responsibility in shaping the future through research, innovation, and dissemination of knowledge. This conference is a reflection of our commitment to nurturing intellectual curiosity and encouraging interdisciplinary exploration. Artificial Intelligence, when aligned with sustainable practices, can serve as a transformative force in addressing global environmental challenges and reducing carbon emissions.

I am confident that the exchange of ideas, research findings, and collaborative discussions during these two days will inspire new directions in both academic inquiry and practical implementation. Such initiatives not only enrich the academic community but also contribute meaningfully to society at large.I extend my sincere appreciation to the organizing committee, keynote speakers, and all participants for their dedication and enthusiasm. May this conference serve as a catalyst for impactful research and sustainable innovations.
With best wishes,

Indian Institute of Management Lucknow
Economics & Business Environment Area
Lucknow, Uttar Pradesh, India

BEST WISHES MESSAGE

I extend my sincere best wishes to the organizers, keynote speakers, and participants of the International Conference on "*AI & Sustainable Approaches for Reducing Carbon Footprint*", scheduled to be held on *March 13-14, 2026*.

The theme of the conference is timely and highly relevant, as it addresses the growing importance of artificial intelligence and sustainable strategies in mitigating environmental challenges and promoting responsible development. Such academic platforms play a crucial role in fostering interdisciplinary dialogue, encouraging innovative research, and supporting evidence-based solutions for global sustainability concerns.

I congratulate *Rajshree Group of Institutions, Bareilly*, for organizing this important academic initiative and wish the conference great success in achieving its objectives.

Jyoti Kumari
Economics & Business Environment Area
Indian Institute of Management Lucknow
Uttar Pradesh, India

ICAI-SACF

भारतीय प्रबंध संस्थान काशीपुर
Indian Institute of Management Kashipur
IIM KASHIPUR

MESSAGE

Education is often described as the seedbed of ideas that shape the future, and initiatives such as this conference truly embody that spirit. Bringing together scholars, practitioners, and thought leaders to deliberate on the intersection of Artificial Intelligence and Sustainability is both timely and commendable. Rajshree Institute of Management and Technology is clearly playing its part in advancing meaningful academic dialogue and responsible innovation. Platforms like these not only spark meaningful conversations but also help translate ideas into action for the larger good.

Thank you once again for reaching out and for your thoughtful initiative. I convey my sincere appreciation to you and the entire organizing team.

With my best wishes for a successful and impactful conference.

Regards,

Atul Kumar Srivastava
Senior Administrative Officer & Secretary to the Board of Governors
Indian Institute of Management Kashipur
Email: atul.srivastava@iimkashipur.ac.in, atulksiitk@gmail.com
https://www.linkedin.com/in/atuliitk

Yamin Ahmed Tusi
Independent Researcher
Indian Institute of Management Ranchi
Chennai, India
Email: yaminahmed.tusi23@iimranchi.ac.in | Mobile: 9791116562

Message for the International Conference on "AI & Sustainable Approaches for Reducing Carbon Footprint (AI & SARCF 2026)"

It is a pleasure to extend my warm greetings and best wishes to the organizers, Advisory Board, speakers, and participants of the International Conference on "AI & Sustainable Approaches for Reducing Carbon Footprint (AI & SARCF 2026)" being organized by Rajshree Group of Institutions, Bareilly, on March 13–14, 2026.

The theme of this conference is both timely and significant, as artificial intelligence and data-driven innovation are increasingly central to addressing climate change, improving resource efficiency, and supporting sustainable development. By bringing together academicians, researchers, students, and industry professionals on a common platform, this event will foster meaningful dialogue, interdisciplinary collaboration, and the co-creation of solutions that can positively impact both policy and practice.

I am confident that the deliberations, research presentations, and networking opportunities during AI & SARCF 2026 will inspire new ideas, strengthen global partnerships, and contribute to the advancement of green and responsible AI for the benefit of society and the environment. I convey my sincere appreciation to the organizers for their dedicated efforts and wish the conference grand success.

Yamin Ahmed Tusi

Member-Advisory Board

AI and Sustainable Approaches for Reducing Carbon Footprint: A Responsible Path Forward

MESSAGE

The global challenge of climate change has compelled governments, industries, and academic institutions to rethink the way economic growth and technological advancement are pursued. One of the most promising developments in recent years has been the integration of Artificial Intelligence (AI) with sustainable development strategies. When applied responsibly, AI can play a transformative role in reducing carbon emissions, optimizing resource consumption, and supporting environmentally conscious decision-making. Artificial Intelligence enables organizations to process large volumes of data and generate predictive insights that were previously difficult to obtain. In sectors such as energy, transportation, manufacturing, and finance, AI-driven systems are helping institutions identify inefficiencies and reduce waste. For instance, smart energy management systems powered by AI can analyze consumption patterns and optimize electricity usage in real time, thereby reducing unnecessary energy expenditure and lowering carbon emissions.

Another important application of AI in sustainability lies in smart urban planning. Rapid urbanization has increased the environmental burden on cities across the world. AI-based analytics can help city planners design efficient traffic management systems, optimize public transportation networks, and reduce congestion. These improvements directly contribute to lowering fuel consumption and minimizing greenhouse gas emissions in metropolitan areas. In the industrial sector, AI is being used to develop predictive maintenance systems that monitor machinery and detect potential failures before they occur. By ensuring that machines operate at optimal efficiency, industries can significantly reduce energy consumption and material waste. Similarly, AI-enabled supply chain optimization allows companies to design logistics networks that minimize transportation distances and reduce carbon footprints. From a financial perspective, sustainable finance and green investments are increasingly relying on AI-driven analytics. Financial institutions are using AI models to evaluate environmental, social, and governance (ESG) risks more effectively. These tools assist investors in identifying environmentally responsible companies and projects, thereby directing capital toward sustainable business models and low-carbon technologies. However, the adoption of AI must itself be guided by principles of responsible innovation. Large-scale data centers and computing infrastructure consume significant amounts of energy. Therefore, it is essential to promote energy-efficient algorithms, green data centers, and responsible data management practices. The goal should be to ensure that the environmental benefits of AI applications outweigh the energy costs associated with their deployment.

Academic institutions have a crucial role to play in this transition. Universities and business schools must encourage interdisciplinary research that integrates technology, sustainability, and responsible governance. By equipping future managers, policymakers, and entrepreneurs with the knowledge of AI-driven sustainability solutions, educational institutions can foster a generation of leaders who prioritize environmental stewardship alongside economic progress. In conclusion, Artificial Intelligence holds immense potential to support sustainable development and reduce the global carbon footprint. Yet, technology alone cannot solve environmental challenges. Collaborative efforts among governments, industry leaders, researchers, and educational institutions are essential to ensure that AI is applied ethically and strategically. Responsible innovation, combined with global cooperation, can pave the way for a more sustainable and resilient future.

Dr. Manta Dey
Associate Professor (Finance)
Techno India University, Kolkata, India

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

F/O ENGINEERING & TECHNOLOGY

JAMIA MILLIA ISLAMIA, NEW DELHI – 110025

Heartiest congratulations to the organizing committee for bringing together global experts for International Conference on "AI & Sustainable Approaches for Reducing Carbon Footprint ", at a time when technological advancement must intersect with environmental stewardship, this conference is a vital step forward.

I am confident that the discussions on AI-driven smart energy systems, and green AI will provide actionable insights for a sustainable future .

Wishing all participants two days of productive dialogue and meaningful collaboration.

Regards

Prof. M. Nizamuddin
Department of Electronics & Communication Engineering,
Jamia Millia Islamia
New Delhi— 110025
(mnizamuddin1@jmi.ac.in)

ICAI-SACF

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KARNATAKA, INDIA

MESSAGE

Dr. Malabika Purkayastha
Assistant Professor
GIBS Business School, Bangalore

Greetings

New Year 2026 has started with a zing, and as we welcome the year with new aspirations, new hopes, and new beginnings, it is my pleasure to extend my warmest greetings to the Rajshree Group of Institutions for hosting the International Conference on "AI & Sustainable Approaches for Reducing Carbon Footprint" on March 13–14, 2026

As we stand at the crossroads between survival and sustainability, this conference provides a much-needed platform for shared learning and knowledge collaboration. Leveraging technologies for wise and pragmatic resource management to reduce carbon emissions is a credible step toward a secure future. I congratulate the Rajshree Group for providing this hybrid platform to foster dialogue between global academicians and industry experts. It is an honor to support this initiative as a member of the Advisory Board.

I wish this conference resounding success and wish all the organizers, delegates, and students a prosperous, healthy, and innovative New Year.

Malabika Purkayastha

Dr. Malabika Purkayastha
Assistant Professor
GIBS Business School, Bangalore

VORTEXUS FUTUROMOTIVE PRIVATE LIMITED

H No 1752/a, Chandsi Building, Purulia Road, Lalpur, Ranchi, Jharkhand, India, 834001

January 21, 2026

I commend the Rajshree Group of Institutions for their foresight in convening this International Conference. The synthesis of artificial intelligence and sustainability represents the defining paradigm of our contemporary industrial landscape, moving beyond a conceptual ideal to become a core strategic imperative for global enterprises.

The conference theme correctly identifies the technological vectors for progress. However, the most profound challenge and opportunity lie not in the technology itself, but in the strategic orchestration of human capital through this transition. This perspective is corroborated by significant research in the field, which identifies the transition to a low-carbon economy as a fundamental human capital imperative.

The strategic mandate, therefore, is to leverage AI beyond operational efficiency. Its true value will be realized in its application to sophisticated workforce planning, the architecture of scalable reskilling ecosystems, and the integration of 'just transition' principles into the framework of corporate governance. By doing so, we convert a potential disruption into a source of sustainable competitive advantage and long-term stakeholder value.

This conference provides the ideal forum for advancing this critical discourse. It is through such focused collaboration that we can develop the robust, actionable models necessary to guide an equitable and prosperous green transition.

I wish all delegates and speakers a productive and insightful deliberation.

Sincerely,

Rochak Arora
Director

ICAI-SACF

Numrovani

MESSAGE

Best Wishes

It is a privilege to be associated with the International Conference on "AI & Sustainable Approaches for Reducing Carbon Footprint," being held on March 13–14, 2026, at Rajshree Group of Institutions, Bareilly (Uttar Pradesh), India.

As humanity enters an era where artificial intelligence increasingly shapes cognition, infrastructure, and decision-making, AI must be understood not merely as a technological tool, but as an evolving form of civilizational intelligence. Its true significance lies not only in efficiency or automation, but in how responsibly it aligns with ecological limits, ethical governance, and collective human values.

In this context, the conference arrives at a crucial inflection point where conversations around AI infrastructure, algorithmic accountability, climate responsibility, and societal impact must converge. Echoing global dialogues emerging from platforms such as the India AI Impact Summit and leading international research ecosystems, this forum advances the idea that sustainable progress demands integration across science, policy, and long-term human foresight.

By fostering interdisciplinary research, evidence-based policy thinking, and ethical innovation, this conference contributes meaningfully to shaping AI systems that are not only powerful, but also purposeful serving planetary resilience, social equity, and generational well-being.

I commend the organizing team for their vision and leadership in convening such a timely and thoughtful platform, and I extend my best wishes for a conference that inspires deep inquiry, responsible innovation, and enduring impact.

Warm regards,

Sidhharrth S. Kumaar

Founder & Chief Researcher

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CHENNAI RAMAPURAM

SRM Institute of Science & Technology

Ramapuram Campus

Reflections and Best Wishes

I am pleased to extend my best wishes to the organizers of the International Conference on *"AI & Sustainable Approaches for Reducing Carbon Footprint (AI & SARCF 2026)."*

At a time when technological advancement must walk hand in hand with environmental responsibility, this conference addresses a theme of immense global relevance. By bringing together academicians, researchers, industry professionals, and policy thinkers from across the world, this initiative promises to foster meaningful dialogue, interdisciplinary collaboration, and actionable insights toward sustainable development.

I commend the Rajshree Group of Institutions for its vision and commitment to advancing knowledge at the intersection of artificial intelligence and sustainability. I am confident that the deliberations and outcomes of this conference will contribute significantly to both academic scholarship and real-world impact.

I wish the conference every success and hope it sets new benchmarks in research excellence, innovation, and global collaboration.

With best wishes for a successful and impactful conference.

22.12.2025

Dr. Praveen Kumar
Dean – Faculty of Management
SRM Institute of Science and Technology
Ramapuram Campus, Chennai

Dr. S. PRAVEEN KUMAR
MA, MBA, M.Sc, M.Phil, Ph.D, FDP (IIM-V)
Professor & Dean
Faculty of Management,
SRM Institute of Science & Technology
Ramapuram, Chennai-600 089.

ICAI-SACF

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Dr. Satyanarayana Rentala

- Associate Professor of Marketing - Bharathidasan Institute of Management (BIM), Trichy
- Chair – Career Development Services and Alumni Relations
- Executive Committee Member – The Indian Academy of Management (INDAM), Indian Affiliate of the Academy of Management (AOM), USA.

MESSAGE

Rajshree Institute of Management and Technology, Bareilly is to be congratulated for choosing such a timely and forward-looking theme in "AI & Sustainable Approaches for Reducing Carbon Footprint" for this international conference. As a member of the Advisory Board, warm wishes are extended to the entire organising committee for bringing together scholars, practitioners and policymakers to explore how intelligent technologies can advance low-carbon, resource-efficient growth. This initiative reflects a strong institutional commitment to responsible innovation and to preparing students and professionals for a future, where digital transformation and environmental stewardship go hand in hand.

May this conference serve as a vibrant platform for rigorous academic dialogue, impactful industry insights and meaningful collaborations that translate into actionable solutions for climate mitigation and sustainable development. I hope that the deliberations during the conference will not only enrich the participants' understanding of AI-enabled sustainability, but will also inspire concrete projects, partnerships and policy ideas that benefit the region, the country and the global community. Wishing the organising team every success for a memorable and impactful conference and for many more such initiatives in the years to come.

(Dr. Satyanarayana Rentala)

AI AND SUSTAINABLE PEAK APPROACHES TO REDUCING THE CARBON FOOTPRINT

I would like to bring my best wishes on the occasion of this important and opportune international conference on the topic of AI and Sustainable Approaches to the Reduction of Carbon footprint. AI nowadays is not only a technology, but it is a disruption technology that can change the way we quantify, handle, and reduce the environmental impact. AI can provide significant capabilities to speed up the sustainability transitions, both in terms of energy consumption optimization and supply chain optimization and in terms of carbon accounting and predictive climate modeling.

Nevertheless, technological creation is not enough. We have to be responsible in our innovation. The AI systems should be open, environmentally friendly, morally controlled, and in line with the long-term environmental and social goals. Accountability, data integrity, and fair access to technological gains should be used to formulate AI integration in the sustainability frameworks.

To minimize carbon footprint, interdisciplinary cooperation is necessary, that is, the unification of data scientists, policymakers, industrial executives, and sustainability researchers. Education and research centers are crucial within this discourse because they create and promote critical thought, evidence-based policy making and scalable innovation.

I summarize that I admire the organizers because they have established a medium of exchange on this urgent matter globally. I would like to wish the conference a big success and hope the discussions would result in the relevant, practical points of action towards a more sustainable and technologically responsible future.

Thank you,

Dr. Kavya Shabu (PhD, eMDP-IIM-K)
Designation: Assistant Professor-Business Analytics, CMS Business School, Jain (Deemed-to-be University), Bengaluru | Founder, Research Dreams |
ORCID: 0000-0002-3781-3860
Email: kavyaseabi01execalumni@iimk.edu.in

ICAI-SACF

रतन टाटा महाराष्ट्र राज्य कौशल्य विद्यापीठ

स्थापना महाराष्ट्र अधिनियम क्रमांक ७/२०२१ दिनांक २३ मार्च, २०२१

MESSAGE

Best Wishes Message

I hope that my best wishes to the organizers, academicians, researchers, policymakers, and industry representatives who find themselves into the conference concerning AIs and Sustainable Approaches in Reducing Carbon Footprint. This conference has a huge national importance at a time when India is determined to meet its climate targets through the Nationally Determined Contributions (NDCs) and implement other projects such as Net Zero 2070, Digital India, and Atmanirbhar Bharat.

Combining artificial intelligence and sustainable development has revolutionary opportunities to enable India to streamline the economic growth against environmental accountability. The discussions and transfer of information at this forum will be instrumental in forming novel, data-driven decisions on curtailing carbon emission in major industries, including energy, manufacturing, agriculture, and urban infrastructure.

I believe that the results of this conference will enhance institutional cooperation, promote the policy-making based on the evidence, and play an important role in helping India reach a low-carbon, resilient and sustainable future. I hope that the conference will be a big success and effective deliberations.

Regards,

Dr. Sumant Wachasundar
Assistant Professor,
Ratan Tata Maharashtra State Skills University,
Nagpur Centre, Maharashtra, India

Prof. Haripriya Rengarajan

Educationist, Researcher, Speaker, Author

Karnataka State President – International Education Council - WICCI

Bengaluru

9900142470

Email

Linkedin

Warm greetings to the Rajshree Group of Institutions. It is indeed an honor to be invited to serve on the Advisory Board for the International Conference on "*AI & Sustainable Approaches for Reducing Carbon Footprint*", scheduled to be held on March 13–14, 2026.

I extend my best wishes to this International Conference focused on Sustainability. May the deliberations foster meaningful dialogue, innovative research, and collaborative solutions that contribute to sustainable development and global well-being. I wish the organizers and participants every success in this significant academic endeavor.

Best Regards,
Haripriya Rengarajan

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MESSAGE

It gives me immense pleasure to extend my heartfelt best wishes to the organizers, speakers, researchers, and participants of the Conference on *"AI & Sustainable Approaches for Reducing Carbon Footprint."* This conference is a timely and significant initiative, addressing one of the most pressing global challenges of our era—environmental sustainability—through the transformative power of artificial intelligence.

As the world increasingly embraces technological advancements, the responsible and ethical application of AI holds tremendous potential in optimizing resources, reducing emissions, and driving sustainable development. This conference provides a valuable platform for academicians, industry experts, policymakers, and researchers to exchange ideas, share best practices, and explore innovative solutions that can contribute meaningfully to a greener and more sustainable future.

I am confident that the deliberations, research presentations, and interactive sessions will inspire insightful discussions, foster collaborations, and lead to actionable outcomes that extend beyond the conference itself. Such initiatives not only enrich academic and professional discourse but also encourage collective responsibility toward environmental conservation.

I wish the conference every success and hope it serves as a catalyst for knowledge creation, innovation, and sustainable impact. May the efforts of all those involved contribute significantly toward shaping a future where technology and sustainability go hand in hand.

Dr. Shweta Batra
Professor & Dean
Asian Business School

A2, Sector 125, Noida – 201303
Ph.: 0120-4594200 I Email: info@abs.edu.in I Web.: www.abs.edu.in

Message for the Conference

I extend my heartfelt congratulations and best wishes to the Organizing Committee of the International Conference on *"AI & Sustainable Approaches for Reducing Carbon Footprint"* being organized by Rajshree Group of Institutions, Bareilly, on March 13–14, 2026.

The theme of the conference is highly relevant and timely, as Artificial Intelligence today plays a transformative role in addressing global sustainability challenges. Integrating AI-driven innovations with sustainable practices has immense potential to reduce carbon footprints, optimize resource utilization, and support responsible economic growth. Such interdisciplinary dialogue is essential to bridge the gap between technological advancement and environmental stewardship.

This conference provides an excellent platform for academicians, researchers, industry experts, and students to exchange ideas, showcase research, and collaboratively work towards sustainable solutions for the future. I am confident that the deliberations and outcomes of this conference will contribute meaningfully to policy, practice, and research in the domains of AI and sustainability.

I commend the organizing team for taking this important initiative and wish the conference every success.

With best regards,

Dr. Kamakshi Malik
Chitkara Business School
Chitkara University, Punjab

SYMBIOSIS CENTRE FOR MANAGEMENT STUDIES, NOIDA
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02/01/2026

BEST WISHES MESSAGE

I extend my heartfelt best wishes to the **Rajshree Group of Institutions**, Bareilly, for organizing the International Conference on ***"AI & Sustainable Approaches for Reducing Carbon Footprint (AI & SARCF 2026)"*** scheduled for March 13–14, 2026.

The theme of the conference is both timely and significant, as it addresses the crucial role of artificial intelligence in promoting sustainable practices and mitigating environmental challenges. Bringing together academics, researchers, industry experts, and students from around the world, this conference promises to be a valuable platform for knowledge exchange, innovation, and meaningful collaboration.

I commend the organizing team for this important initiative and am confident that the conference will lead to insightful discussions, impactful research outcomes, and long-term contributions toward a sustainable future.

I wish the conference every success and look forward to its positive impact on academia, industry, and society as a whole.

Dr. Harjit Singh
Professor of Finance
Symbiosis Centre for Management Studies, Noida
Symbiosis International University, Pune
India
Email: harjit.singh@scmsnoida.ac.in

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Message from Kishalay Raj, Advisory Board Member – AI & SARCF 2026

Dear Esteemed Participants,

It is a privilege to extend my warm wishes to all organizers, speakers, and participants of the **International Conference on "AI & Sustainable Approaches for Reducing Carbon Footprint (AI & SARCF 2026)."**

In today's world, where sustainable development and responsible innovation are more critical than ever, this conference serves as a vital platform for knowledge, collaboration, and action. By bringing together researchers, academicians, industry experts, and students from across the globe, it encourages the exchange of ideas, fosters interdisciplinary dialogue, and inspires practical solutions to reduce our carbon footprint.

I congratulate the organizers for their vision and dedication in making this event possible. I hope the conference sparks innovative thinking, meaningful partnerships, and actionable insights that will contribute to a sustainable future for communities worldwide.

Wishing everyone a productive, engaging, and inspiring conference.

Kishalay Raj

Kishalay Raj
Member, Advisory Board – AI & SARCF 2026
Research and development (R&D) Lead, Technology & Business Expert – SRJ Peety Steels Private Limited,
Alumnus – **BIT Mesra | IIT Gandhinagar | IIM Bangalore**

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TAMILNADU, INDIA

Dr. B. Gayathri, MCA., M.Phil.,Ph.D.,
AssociateProfessor ofComputerScience - SF – II
Mobile: 6380493741 Email ID: gayathri.cs@bhc.edu.in

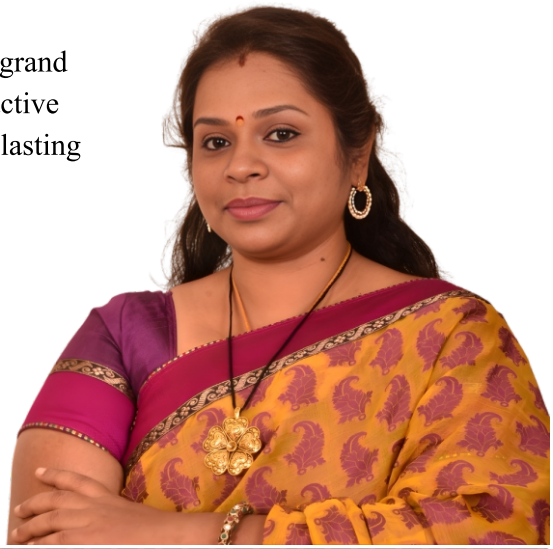
MESSAGE

I am pleased to convey my best wishes to the organizers and participants of the International Conference on "AI & Sustainable Approaches for Reducing Carbon Footprint (AI & SARCF 2026)", scheduled to be held on March 13–14, 2026, at Rajshree Group of Institutions, Bareilly, India.

The conference theme is highly relevant in the contemporary global context, as it emphasizes the transformative role of Artificial Intelligence in advancing sustainable development and addressing environmental challenges. Such scholarly platforms are instrumental in promoting interdisciplinary research, innovation, and international collaboration aligned with global sustainability goals.

I commend the organizing committee for their initiative in bringing together academicians, researchers, industry professionals, and students from diverse backgrounds to engage in meaningful academic discourse and knowledge exchange. I am confident that the deliberations and outcomes of this conference will contribute significantly to research, policy perspectives, and practical applications in the domain of sustainability and intelligent systems.

I extend my sincere best wishes for the grand success of the conference and for productive deliberations that lead to impactful and lasting contributions.



With warm regards,

Dr. B. Gayathri
Associate Professor
Department of Computer Science
Bishop Heber College
Tiruchirappalli, Tamil Nadu, India

ICFAI UNIVERSITY JHARKHAND
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Message

It is with great enthusiasm that I extend my heartfelt wishes to the organizers, speakers, and participants of the conference *"AI & Sustainable Approaches for Reducing Carbon Footprint"*

This gathering marks a vital step in harnessing the power of artificial intelligence to address one of humanity's most pressing challenges climate change. By uniting innovation with sustainability, the conference paves the way for transformative solutions that can reduce carbon footprints, inspire responsible practices, and shape a greener future.

May the deliberations spark bold ideas, foster meaningful collaborations, and ignite actionable pathways toward a world where technology and sustainability walk hand in hand. Wishing the conference resounding success and lasting impact for generations to come.

Dr.Mridanish Jha
Associate Professor
H.O.D - MBA
The ICFAI University Jharkhand, Ranchi

AMITY UNIVERSITY PATNA

January 12, 2026

MESSAGE

I am happy to know that the Rajshree Group of Institutions, Bareilly, is organising an "**International Conference**" on the theme "**AI & Sustainable Approaches for Reducing Carbon Footprint**" from**March 13–14, 2026.**

I appreciate their efforts to choose a platform to bring together experts, researchers, and practitioners to explore innovative solutions for a greener future. The Conference is a significant step towards exploring cutting-edge solutions for a sustainable future. I am confident that the hybrid format will facilitate rich discussions, innovative ideas, and meaningful collaborations.

I extend my greetings and felicitations to all those associated with the Conference and wish the conference all success.

Dr. Sweta Singh
Assistant Professor
Amity School of Business
Amity University, Patna

MESSAGE

Message

It gives me immense pleasure to extend my best wishes to Rajshree Group of Institutions, Bareilly (U.P.), India, for organizing the **International Conference on "AI & Sustainable Approaches for Reducing Carbon Footprint"** scheduled on 13–14 March 2026

In the present era, where the global community is grappling with the pressing challenges of climate change and environmental degradation, the integration of Artificial Intelligence with sustainable practices offers promising pathways toward reducing carbon footprints and fostering responsible development. The theme of this conference is both timely and significant, as it addresses the urgent need for innovative, technology-driven solutions that balance progress with environmental stewardship.

Conferences of this nature serve as an invaluable platform for academicians, researchers, industry professionals, and students to engage in meaningful dialogue, exchange ideas, and explore interdisciplinary approaches to complex global challenges. I am confident that the deliberations, research presentations, and collaborative discussions during this conference will contribute significantly to advancing knowledge and inspiring impactful research and practical solutions.

I sincerely appreciate the efforts of the organizing committee for conceptualizing this international academic forum in collaboration with global partner universities. Such initiatives reflect a strong commitment to academic excellence, innovation, and sustainability.

I wish the conference a grand success and hope it achieves its intended objectives while fostering enduring academic collaborations and actionable insights for a sustainable future.

Sujata Panda

Warm regards,
Prof. Sujata Panda
O. P. Jindal University, Raigarh

BEST WISHES MESSAGE

"I am pleased to extend my best wishes to the organizers of the International Conference on ***'AI & Sustainable Approaches for Reducing Carbon Footprint'***. The theme of the conference is highly contemporary and aligns closely with the quality benchmarks and academic priorities advocated by the National Assessment and Accreditation Council (NAAC) and the University Grants Commission (UGC), as well as the transformative vision of the National Education Policy (NEP) 2020, which emphasizes multidisciplinary education, research-led learning, innovation, and sustainability. By integrating artificial intelligence with environmentally sustainable practices, the conference meaningfully supports Outcome-Based Education (OBE) through the promotion of critical thinking, problem-solving, and application-oriented research. The focus of the conference also resonates strongly with the United Nations Sustainable Development Goals, particularly SDG 9 (Industry, Innovation and Infrastructure), SDG 11 (Sustainable Cities and Communities), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action).

I am confident that the deliberations will facilitate meaningful academic exchange, foster collaborative research, and encourage the adoption of responsible and sustainable technological solutions. I commend the organizing institution for this significant academic initiative and wish the conference every success in contributing to a greener, more resilient, and sustainable future."

Name: Dr. Shilpa Verma
Designation: Assistant Professor
University: ATLAS SkillTech University
City & Country: Mumbai, India

MESSAGE

J. C. Bose University of Science & Technology, YMCA, Faridabad
(A Haryana State Government University)
(Established by Haryana State Legislative Act No. of 21 of 2009&
Recognised by UGC Act 1956 u/s 22 to confer Degrees)

I extend my warmest greetings and best wishes to the organizers and participants of this conference. The theme is both timely and significant, addressing critical challenges and opportunities in today's rapidly evolving academic and policy landscape. The conference aims to enhance its international visibility and academic standing through collaboration with leading global institutions, research networks, and professional bodies, alongside the dissemination of selected works through indexed journals and edited volumes.

Emerging research in the area of **AI and sustainable approaches for reducing carbon footprint** increasingly focuses on the use of artificial intelligence for accurate carbon accounting, emissions monitoring, and ESG reporting through real-time data analytics and automated verification systems. Research on green fintech and sustainable finance highlights the role of AI in climate-risk assessment, green investment decisions, and financing the low-carbon transition.

I am confident that the deliberations, exchange of ideas, and interdisciplinary discussions during this conference will generate valuable insights, foster meaningful collaborations, and contribute to high-quality research with strong societal relevance.

I wish the conference every success and hope it serves as a stimulating platform for innovation, scholarly excellence, and global academic engagement.

Best Wishes,

Dr. Manisha Goyal
M.Com (Gold Medalist), PhD (Finance)
Assistant Professor
Department of Business Studies
JCBUST, YMCA, Faridabad
Haryana, India, 121006

ICAI-SACF

MESSAGE

Goel Institute of Technology & Management

(Under Sri Roop Chand Ramji Lal Educational Trust)
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Near Indira Canal, Faizabad Road, Lucknow E mail : goel.institute@gmail.com, Web : www.goel.edu.in
Ph.: +91 90440 68698, 90440 68699, 97934 45559

Ref.....—.....

Date.....26/12/2025.....

I am honored to accept the invitation and pleased to convey my consent to serve as a member of the Advisory Board for this conference. I appreciate the confidence you have placed in my academic experience, and I look forward to contributing meaningfully to the planning and success of this important academic event.

The conference theme is both timely and significant, and I am confident that it will provide an excellent platform for academicians, researchers, industry professionals, and students to engage in insightful discussions and knowledge exchange.

I shall also be happy to share my best wishes to the organizing committee and hope for a good engagement, inspiration and rewards for all the participants.

Thank and Regards,

Aman Verma 26/12/25

Aman Verma,

Assistant Professor,

Goel Institute of Technology and Management,

Lucknow, Uttar Pradesh.

ICAI-SACF

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Date: 23rd December, 2025

To,

Dr. Raveesh Agarwal
Professor and Head,
Department of Business Administration
Rajshree Institute of Management & Technology
Bareilly, U.P., India.

Respected Sir,

It gives me immense pleasure to extend my heartfelt congratulations and best wishes to the organizers, participants, and delegates of the International Conference on "AI & Sustainable Approaches for Reducing Carbon Footprint" being organized by the Rajshree Group of Institutions, Bareilly (U.P.), India.

This conference represents a timely and vital initiative, bringing together scholars, researchers, and industry leaders to deliberate on how artificial intelligence can be harnessed to promote sustainability and mitigate the global challenge of climate change. The convergence of AI and sustainable practices holds tremendous potential for reshaping industries, enhancing environmental resilience, and advancing the United Nations' Sustainable Development Goals (SDGs).

I commend the organizers for creating this academic platform that fosters collaboration, innovation, and interdisciplinary dialogue. I am confident that the discussions and outcomes of this conference will contribute meaningfully to global sustainability discourse and inspire actionable insights for a greener future.

My best wishes for the grand success of the conference and for fruitful deliberations ahead.

Warm regards,

Dr. Sudeshna Sarkar
Assistant Professor – Commerce & Finance
Arka Jain University, Jharkhand, India
Email: sudeshna.mmtjsr@gmail.com

CARDAMOM PLANTERS' ASSOCIATION COLLEGE

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Pankajam Nagar, Bodinayakanur, Theni Dt.
Tamil Nadu - 625513
Affiliated to Madurai Kamaraj University

Post-Graduate and Research Department of Commerce

MESSAGE

I am pleased to be an Advisory Member of the Conference on "AI & Sustainable Approaches for Reducing Carbon Footprint" to be held on March 13–14, 2026.This conference addresses an important global need by bringing together ideas on how Artificial Intelligence can support sustainability and environmental protection. I appreciate the efforts of the organizers in creating a platform for meaningful discussion, research, and innovation.

I wish the conference great success and hope it inspires valuable insights and practical solutions for a sustainable future.

(Dr.A.SUJATHA)

SCHOOL OF COMMERCE & MANAGEMENT (SCM)
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Founder President & Chancellor - Late Prof. Dr. (Col) A. Balasubramanian
A Private University established under sub-section(3) of section 48 of the SBUP, Act, 2019 (Mah. Act No.XII of 2019) vide Notification No. SFU 2018/C.R.282/Uni.4 Govt. of Maharashtra & Courses Approved by AICTE, ministry of HRD, Govt. of India.
55/2-7 Tathawade, Off Mumbai-Bangalore Bypass, Pune - 411033, Landmark: Near Decathlon, Bhumkar Chowk.
Telephone: +91 20 66741196/97/98 E-mail: principal@ sbup.edu.in Website: www.sbup.edu.in

Best Wishes Message

It gives me immense pleasure to extend my heartfelt congratulations and best wishes to the Rajshree Group of Institutions, Bareilly, on the organization of the International Conference on "AI & Sustainable Approaches for Reducing Carbon Footprint," scheduled on March 13–14, 2026.

This conference is a commendable initiative that brings together academicians, researchers, industry professionals, and students from across the globe to deliberate on one of the most pressing priorities of our time — the need to integrate advanced technologies such as Artificial Intelligence with sustainable development practices. As the world strives to address environmental challenges and climate change, such intellectual platforms play a crucial role in fostering learning, collaboration, and innovative thinking.

I am confident that the discussions, research insights, and collaborative exchanges during this conference will contribute significantly toward building environmentally responsible solutions and inspire further academic and industrial initiatives in this vital domain. The efforts of the organizers in creating this knowledge-sharing forum are truly praiseworthy.

I extend my warm wishes to the organizing committee, distinguished speakers, participants, and delegates for a highly enriching and successful conference. May this event lead to meaningful outcomes and lasting contributions toward a sustainable and greener future.

With warm regards and best wishes for the grand success of the conference.

Dr. Dipak Umbarkar
PhD., MBA, Marketing & HRM, NET-JRF, SET, B. Pharm
Assistant Professor
School of Commerce & Management
Sri Balaji University, Pune

8/11/26
In-charge Principal
School of Commerce & Management
Sri Balaji University, Pune

BRAINWARE UNIVERSITY
We Make Careers

MESSAGE

I am delighted to extend my best wishes to Rajshree Group of Institutions, Bareilly (U.P.), India, on the occasion of the Two-Day International Conference on “AI & Sustainable Approaches for Reducing Carbon Footprint”, scheduled to be held on March 13–14, 2026.

The theme of the conference is both timely and significant, as Artificial Intelligence and sustainable practices are emerging as powerful tools in addressing global environmental challenges. This conference provides an excellent platform for academicians, researchers, industry professionals, and students from across the globe to exchange ideas, share innovative research, and foster meaningful collaborations to build a greener, more sustainable future.

I commend the organising committee for taking this valuable initiative and for bringing together distinguished experts and institutions at an international level. I am confident that the deliberations and outcomes of this conference will contribute significantly to knowledge advancement, policy development, and practical solutions for reducing carbon footprints through intelligent and sustainable approaches.

I wish the conference every success and hope it achieves its objectives in inspiring innovation, collaboration, and impactful research.

With best regards,

Arunika Bhadra
Assistant professor
Department of Hospital Management
Brainware University, Kolkata

St. Xavier's College Jaipur

(Affiliated to the University of Rajasthan, Jaipur)

Accredited with A Grade by NAAC (First Cycle, 2025)

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Message

I am delighted to extend my warmest greetings and best wishes to the organizing committee, participants, and distinguished guests of the two-day International Conference on "AI & Sustainable Approaches for Reducing Carbon Footprint", being organized by Rajshree Group of Institutions, Bareilly, on March 13–14, 2026.

The theme of this conference is both timely and significant, addressing the critical intersection of artificial intelligence and sustainability at a moment when innovative, technology-driven solutions are urgently needed to mitigate climate change and promote responsible development. Such academic platforms play a vital role in fostering interdisciplinary dialogue, encouraging cutting-edge research, and translating knowledge into impactful societal outcomes.

I commend the conference team for their vision, dedication, and commitment to maintaining high academic standards while facilitating meaningful international collaboration through a hybrid mode.

I am confident that this conference will provide an enriching forum for researchers, academicians, industry experts, and policymakers to exchange ideas, explore emerging research directions, and build lasting academic networks. I wish the conference every success and hope it serves as a catalyst for innovative research, sustainable practices, and global academic cooperation.

With best wishes for a fruitful and impactful conference.

Dr. Mahua Majumdar
St. Xavier's College
Jaipur

ICAI-SACF

IILM UNIVERSITY

Date: 23rd December, 2025

IILM University
1, Knowledge Center
Golf Course Road
Sector 53, Gurugram – 122003
Haryana, India
www.iilm.edu

MESSAGE

Best Wishes Message

I extend my heartfelt best wishes to the organizers of the International Conference on *"AI & Sustainable Approaches for Reducing Carbon Footprint (AI & SARCF 2026)"*, scheduled on March 13–14, 2026, at Rajshree Group of Institutions, Bareilly, U.P., India.

The conference theme is timely and highly relevant, as the integration of Artificial Intelligence with sustainable practices holds immense potential to address global environmental challenges and promote responsible innovation. This academic platform will undoubtedly foster meaningful dialogue, interdisciplinary collaboration, and impactful research outcomes among scholars, practitioners, and industry experts.

I commend the organizing team for this significant initiative and wish the conference every success in achieving its academic and societal objectives.

With best Regards,

Dr. Neha Kamboj
Assistant Professor
MBA Program Coordinator
School of Management
IILM University, Gurugram

Date: 23-12-2025

Dear Sir,

I extend my warm greetings and heartfelt best wishes to the Rajshree Group of Institutions, Bareilly, for organizing the two-day International Conference on **"AI & Sustainable Approaches for Reducing Carbon Footprint"** scheduled for March 13–14, 2026.

The theme of the conference is both timely and significant, as the integration of Artificial Intelligence with sustainable practices holds immense potential in addressing one of the most pressing global challenges—climate change. This international forum will undoubtedly serve as a valuable platform for academicians, researchers, industry professionals, and students to exchange ideas, share innovative research, and foster meaningful collaborations across disciplines and borders.

I appreciate the initiative of organizing this conference in collaboration with international partner universities and in a hybrid mode, which will further enhance global participation and knowledge dissemination. I am confident that the deliberations and outcomes of this conference will make a substantial contribution to advancing research, policy, and practice in the domains of AI-driven sustainability and carbon footprint reduction.

I congratulate the organising committee for this commendable effort and wish the conference every success.

With best regards,

MANAV RACHNA UNIVERSITY FARIDABAD

Dr. Minakshi Sharma
Assistant Professor
School of Business
Manav Rachna University, Faridabad

जे.सी. बोस विज्ञान एवं प्रौद्योगिकी विश्वविद्यालय, वाईएमसीए, फरीदाबाद (हरियाणा)
J.C. Bose University of Science and Technology, YMCA, Faridabad (Haryana)
Accredited 'A+' Grade by NAAC, State Government University
A State Government University Established vide State Legislative Act No. 21 of 2009
Sector-6, Faridabad - 121006 (HARYANA)
Ph.: 0129-2310104, 2310160 | Website: www.jcboseust.ac.in

Ref.: JCBUST/EE/2025/915

Date : 31.12.2025

Best Wishes

I am pleased to convey my best wishes to **Rajshree Institute of Management & Technology Bareilly, U.P., India** for organizing International Conference on **AI & Sustainable Approaches for Reducing Carbon Footprint (AI & SARCF 2026)**. The conference theme is highly relevant in the current technological landscape, where advances in articial intelligence, intelligent electronic systems, and data-driven decision-making are increasingly shaping sustainable development pathways.

The integration of AI with electronics-based sensing, embedded systems, smart energy management, and optimization frameworks has signicant potential to reduce carbon emissions and mitigate environmental pollution across key sectors such as power systems, manufacturing, transportation, and smart infrastructure. These technologies enable real-time monitoring and predictive control, which are essential for achieving measurable reductions in pollution levels.

Academic forums such as this conference play a vital role in translating theoretical research into scalable, real-world solutions. I am hopeful that the ideas and innovations emerging from this conference will contribute meaningfully toward cleaner environments and a healthier future for generations to come.

I am condent that the deliberations and interdisciplinary interactions during the conference will foster innovative ideas, strengthen industryacademia collaboration and low-carbon technological development. I wish the conference every success and a productive outcome.

Dr. Manju Kumari
SPOC, SWAYAM-MOOC
University Computer Centre & Digital Affairs
J. C. Bose University of Science & Technology, YMCA
Faridabad, Haryana (INDIA)
Email Id : manjukumari@jcboseust.ac.in

ICFAI Foundation for Higher Education
(Deemed-to-be-University under Section 3 of the UGC Act, 1956)
Bangalore

#231, Baba Sabarapalya, Mysore Road, Near Check Post,
Kengeri, Bengaluru – 560060, Karnataka, India
Telephone: 080-66222222
Email: ibsbng@ibsindia.org

Best Wishes Message

I am pleased to extend my best wishes to the International Conference on **"AI & Sustainable Approaches for Reducing Carbon Footprint"**, organized by Rajshree Group of Institutions, Bareilly, on 13–14 March 2026.

The conference theme is timely and relevant, emphasizing the growing role of artificial intelligence in advancing sustainable and environmentally responsible solutions. I am confident that the conference will facilitate meaningful academic exchange, interdisciplinary collaboration, and impactful research discussions.

I wish the organizers and participants every success and a highly productive conference.

Dr. Niharika Singh
Assistant Professor
ICFAI Foundation for Higher Education, Bangalore

MESSAGE OF FELICITATION

Mr. Pawan Kataria
Assistant Registrar
NIT Raipur

MESSAGE

It gives me immense pleasure to extend my heartiest congratulations to Rajshree Group of Institutions, Bareilly, for organizing the International Conference on **"AI & Sustainable Approaches for Reducing Carbon Footprint"** on March 13–14, 2026.

In today's rapidly evolving world, the intersection of Artificial Intelligence and environmental sustainability represents one of the most promising frontiers for addressing global challenges. Climate change and carbon emissions pose significant threats to our planet, and it is imperative that we harness the power of emerging technologies to develop innovative and sustainable solutions.

This conference provides an excellent platform for academicians, researchers, scientists, and industry professionals to converge, collaborate, and contribute toward creating a sustainable future. The exchange of knowledge, innovative ideas, and best practices in AI-driven sustainability will undoubtedly pave the way for meaningful interventions in reducing our carbon footprint.

I commend the organizing committee for their vision in bringing together diverse perspectives on this critical theme. Such initiatives play a crucial role in fostering interdisciplinary research and promoting practical applications that can make a tangible difference in environmental conservation.

I am confident that this conference will serve as a catalyst for groundbreaking research and inspire participants to develop actionable strategies for a greener, more sustainable tomorrow.

I wish the conference great success and hope that it achieves its objectives of advancing knowledge and creating impactful solutions for environmental sustainability.

Greetings from the Day.

I would like to thank you for giving opportunity. I am honoured to join this global dialogue on**AI & Sustainable Approaches for Reducing Carbon Footprint.**

As we face an unprecedented climate crisis, Artificial Intelligence is no longer just a tool for efficiency—it is a critical catalyst for **decarbonisation**. From optimising smart grids and predicting renewable energy yields to revolutionising supply chain transparency, AI empowers us to turn massive data sets into **actionable climate solutions.**

Our goal at this conference is to bridge the gap between cutting-edge technology and environmental stewardship. By fostering international collaboration, we can ensure that AI development itself remains sustainable while providing the precision needed to reach **Net Zero** targets. Let's innovate with "purpose."

Thank you

With regards,

Dr.VeniceMairya David
Principal
Late Zyade College of Nursing, Chanderpur
MUHS Nasik
Maharashtra
India

जम्मू केंद्रीय विश्वविद्यालय

CENTRAL UNIVERSITY OF JAMMU

DEPARTMENT OF HUMAN RESOURCE MANAGEMENT

राया–सूचानी बागला, जिला सांबा–181143, जम्मू ;जम्मू एवं कश्मीर

Rahya –Suchani (Bagla), District Samba -181143,Jammu (Jammu & Kashmir)

MESSAGE

DearSir/Madam,

Namaskar!

Best wishes for the successful organization of the International Conference on **"AI & Sustainable Approaches for Reducing Carbon Footprint."** This conference serve as a meaningful platform for scholars, researchers, academicians, industry experts and practitioners to exchange innovative ideas, foster collaborations, and contribute significantly toward sustainable and environmentally responsible solutions. Wishing the organizers and participants a highly productive and inspiring conference.

The deliberations lead to insightful discussions, innovative research outcomes, and actionable strategies that advance sustainability through artificial intelligence. Wishing the conference great success and impactful outcomes.

May the conference inspire meaningful dialogue, innovative research, and collaborative efforts toward a greener and more sustainable future.

I also with that this conference provides an enriching platform for researchers, Wishing the organizing team and participants a highly productive, insightful, and impactful conference. Season's greetings for a joyful Christmas and a New Year filled with progress, innovation, and sustainability.

Prof. Jaya Bhasin

Central University of Jammu

REFORMED CHURCH UNIVERSITY

Message

Greetings from Reformed Church University. I'm honored to support the Two-Day International Conference on “AI & Sustainable Approaches for Reducing Carbon Footprint”.I really want to congratulate Rajshree Institute of Management &Technology and its international collaborators for coming up with such a conference that addresses critical global contemporary challenges. As AI continues to transform industries, it's crucial we leverage its potential for climate action. By developing sustainable AI solutions, we can reduce carbon footprints, optimize resource use, and drive environmental impact.Let's collaborate on responsible innovation for a greener future. I have the confidence that the conference will give an opportunity for academics, industry, and commerce to interface and cross pollinate ideas and skills for a sustainable future.Thank you, Rajshree Institute and collaborators for hosting this important event.

"Prof.Jeriphanos Makaye.

Prof.Jeriphanos Makaye
Pro-Vice Chancellor,
Reformed Church University, Zimbabwe

MESSAGE

Rajshree
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Prof. (Dr.) Pankaj Kumar Sharma
Director
Rajshree Group of Institutions
Bareilly (U.P.) India

It is a matter of great academic pride that Rajshree Group of Institutions, Bareilly (U.P.), India is hosting a two-day International Conference on "AI & Sustainable Approaches for Reducing Carbon Footprint" on March 13–14, 2026, in hybrid mode at the Rajshree Institute campus.

In the present era of rapid technological advancement, Artificial Intelligence has become a transformative force with the potential to reshape how societies address critical global challenges. Among these challenges, environmental sustainability and the reduction of carbon emissions demand urgent, innovative, and collaborative solutions. Academic institutions play a vital role in generating knowledge, encouraging interdisciplinary research, and preparing future leaders who can apply technology responsibly for sustainable development.This conference has been conceptualized as an intellectual platform where researchers, academicians, professionals, and students can engage in meaningful dialogue on the intersection of AI, sustainability, and environmental responsibility. The research contributions compiled in these proceedings reflect diverse perspectives and innovative ideas that may contribute to shaping more sustainable technological practices.

I sincerely hope that the discussions and scholarly works presented during this conference will inspire further research, strengthen academic collaborations, and promote the responsible application of emerging technologies for the benefit of society and the environment.I congratulate the organizing team for their dedicated efforts in bringing together such a significant academic event and extend my best wishes to all the participants for a highly productive and enriching conference experience.

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MESSAGE

Prof. (Dr.) Anil Kumar
Director (Academics)
Rajshree Group of Institutions
Bareilly (U.P.) India

It is truly encouraging to observe academic institutions taking proactive initiatives to address the pressing environmental challenges of our time through research and intellectual collaboration. In this regard, I am pleased to note that Rajshree Group of Institutions, Bareilly (U.P.), India is organizing a two-day International Conference on "AI & Sustainable Approaches for Reducing Carbon Footprint" on March 13–14, 2026, in hybrid mode at the Rajshree Institute campus.

The intersection of Artificial Intelligence and environmental sustainability represents one of the most promising frontiers in contemporary research. As the world grapples with climate change and increasing carbon emissions, the responsible application of advanced digital technologies has the potential to redefine the pathways through which societies pursue sustainable development. In this context, academic institutions have a critical responsibility not only to generate new knowledge but also to cultivate innovative thinking that bridges technology, policy, and environmental stewardship.

This conference aims to serve as an interdisciplinary forum where scholars, researchers, industry professionals, and policy thinkerscan deliberate upon emerging research, share empirical findings, and explore transformative strategies that leverage AI to support sustainable practices and carbon reduction initiatives. The research contributions compiled in these proceedings reflect the growing global discourse on integrating technological intelligence with ecological responsibility.I am confident that the scholarly deliberations and collaborative exchanges facilitated through this conference will stimulate meaningful research directions, strengthen academic networks, and contribute valuable insights toward building a more sustainable and technologically responsible future.I extend my sincere appreciation to the organizing committee, reviewers, contributors, and participants whose efforts have made this academic endeavor possible. I wish the conference great success and hope that its outcomes will inspire continued research and innovation in the domain of AI-driven sustainability.

With best wishes for a successful and intellectually enriching conference.

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Prof. (Dr.) Subhash Chandra Singh Rawat,
Principal
Rajshree Ayurvedic Medical College & Hospital, Bareilly

On behalf of Rajshree Group of Institutions, Bareilly (U.P.), India, I am delighted to welcome you to the International Conference on AI & Sustainable Approaches for Reducing Carbon Footprint, scheduled on March 13–14, 2026 in hybrid mode at our campus.

As an institution, we recognize that operational excellence today must be inseparable from environmental responsibility. Artificial Intelligence provides powerful tools to streamline processes, optimize resource utilization, and design sustainable frameworks that can significantly reduce carbon emissions. This conference is not only an academic gathering but also a practical initiative to explore how technology can be implemented effectively to achieve measurable impact.

We are proud to host a platform where researchers, industry leaders, and academicians converge to share insights and strategies. The hybrid format ensures inclusivity, enabling participation from across the globe while minimizing travel-related carbon footprints—an example of sustainability in action.

I extend my appreciation to the organizing committee and all contributors for their tireless efforts. I am confident that the discussions will inspire actionable solutions and foster collaborations that bridge the gap between research and real-world implementation.

With blessings and best wishes,

ICAI-SACF

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MESSAGE

Prof. (Dr.) Saket Agarwal
Dean (Academics)
Rajshree Group of Institutions
Bareilly (U.P.) India

It is indeed encouraging to witness the growing academic commitment toward addressing global environmental challenges through technological innovation. I am delighted that Rajshree Group of Institutions, Bareillyis organizing International Conference on “AI & Sustainable Approaches for Reducing Carbon Footprint” on March 13–14, 2026. In the contemporary knowledge-driven world, higher education institutions have a critical responsibility to promote research that not only advances technology but also contributes meaningfully to sustainable development. Artificial Intelligence, when guided by ethical and ecological considerations, has the potential to transform how societies monitor environmental changes, optimize resource utilization, and design sustainable systems for the future.

This conference represents an important academic initiative that brings together research scholars, academicians, practitioners, and policymakers to examine the emerging interface between intelligent technologies and environmental responsibility. The scholarly works compiled in these proceedings reflect a wide range of perspectives and research insights that contribute to the ongoing discourse on sustainable innovation.I believe that such platforms are essential for nurturing interdisciplinary dialogue and encouraging young researchers to explore solutions that align technological progress with ecological balance. The exchange of ideas during this conference will undoubtedly stimulate new research collaborations and inspire practical approaches toward reducing the global carbon footprint.

I congratulate the organizing committee for their dedicated works in conceptualizing and successfully organizing this important academic event. I also extend my best wishes to all contributors and participants for a highly productive and intellectually rewarding conference.

With sincere appreciation and best wishes for the success of the conference.

Rajshree
GROUP OF INSTITUTIONS
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Dr. Mukesh Pal Gangwar
Principal

It is a privilege to welcome all participants to the International Conference on AI & Sustainable Approaches for Reducing Carbon Footprint, organized by Rajshree Group of Institutions, Bareilly (U.P.), India on March 13-14, 2026 in hybrid mode at our campus.

Academic excellence thrives when research addresses real-world challenges. This conference exemplifies our institutional vision of integrating cutting-edge technology with sustainable development goals. Artificial Intelligence, as a rapidly evolving discipline, offers immense scope for designing intelligent systems that not only enhance efficiency but also contribute to reducing environmental impact. By focusing on carbon footprint reduction, we are aligning academic inquiry with global priorities and societal needs.

The strength of this conference lies in its interdisciplinary naturebringing together computer science, engineering, environmental studies, management, and social sciences. Such convergence of ideas is essential for generating holistic solutions that are both scientifically rigorous and practically viable.

I extend my sincere gratitude to the organizing committee, keynote speakers, and participants for their scholarly contributions. I am confident that the deliberations will enrich academic discourse, inspire collaborative research, and pave the way for innovations that balance technological advancement with ecological responsibility.

Preface

AI & Sustainable Approaches for Reducing Carbon Footprint

The twenty-first century is witnessing an unprecedented convergence of technological progress and environmental urgency. While rapid industrialization, globalization, and technological advancement have significantly enhanced human well-being and economic development, they have simultaneously intensified environmental pressures on the planet. Among the most pressing concerns confronting the global community today is the escalating level of greenhouse gas emissions, which has contributed to climate instability, rising global temperatures, and widespread ecological disruption. The growing recognition of these environmental challenges has compelled governments, industries, researchers, and civil society to explore innovative and sustainable solutions that can effectively reduce carbon emissions while maintaining economic progress.

In this evolving global context, artificial intelligence (AI) has emerged as a transformative technological force with the potential to reshape how societies understand, monitor, and respond to environmental challenges. AI technologies enable advanced data processing, predictive modeling, and intelligent decision-making capabilities that can support more efficient resource management and climate mitigation strategies. When integrated with sustainable development principles, AI can help identify patterns of energy consumption, optimize industrial processes, enhance renewable energy systems, and support the transition toward low-carbon economies.

The theme "AI and Sustainable Approaches for Reducing Carbon Footprint" therefore represents a timely and significant area of inquiry for scholars, policymakers, and practitioners. By combining insights from technological innovation, environmental science, and sustainability studies, this field offers promising pathways for addressing climate change and promoting responsible development. This preface aims to provide a conceptual overview of the intersection between artificial intelligence and sustainable practices, highlighting how emerging digital technologies can contribute to reducing carbon footprints and advancing global climate objectives.

Artificial Intelligence Concept

Artificial Intelligence refers broadly to the development of computer systems capable of performing tasks that typically require human intelligence. These tasks include learning from data, recognizing patterns, interpreting complex information, and making informed decisions. Over the past decade, the rapid advancement of machine learning, deep learning, natural language processing, and data analytics has significantly expanded the capabilities of AI systems.The growing availability of large datasets and high-performance computing infrastructure has further accelerated the application of AI across diverse sectors such as healthcare, finance, education, transportation, and manufacturing. More recently, attention has increasingly turned toward the role of AI in addressing environmental and sustainability challenges.

AI technologies possess several characteristics that make them particularly valuable in the context of environmental management. They can process vast volumes of environmental data collected from sensors, satellites, and monitoring networks; identify hidden patterns in complex datasets; and generate predictive models that support evidence-based decision-making. These capabilities enable policymakers and organizations to develop more effcient strategies for managing natural resources, reducing energy consumption, and mitigating environmental risks.Furthermore, the integration of AI with complementary technologies such as the Internet of Things (IoT), remote sensing systems, and cloud computing has created powerful digital ecosystems capable of supporting real-time environmental monitoring and adaptive sustainability strategies.

Carbon Footprint and Emission Scopes

Understanding and measuring carbon emissions is a fundamental step in addressing climate change. The concept of a carbon footprint refers to the total amount of greenhouse gases released into the atmosphere as a result of human activities. These emissions are typically measured in terms of carbon dioxide equivalents (Co2e), which allow different greenhouse gases to be compared based on their relative impact on global warming.Carbon footprints can be associated with individuals, organizations, industries, products, or entire nations. Measuring these emissions provides valuable insights into how energy consumption, industrial processes, transportation systems, and consumption patterns contribute to environmental impact.

To facilitate systematic carbon management, emissions are commonly classified into three categories known as Scope 1, Scope 2, and Scope 3 emissions. Scope 1 emissions represent direct greenhouse gas emissions generated from sources owned or controlled by an organization, such as fuel combustion in company facilities or vehicles. Scope 2 emissions refer to indirect emissions associated with the consumption of purchased electricity, heating, or cooling. Scope 3 emissions encompass a broader range of indirect emissions that occur throughout an organization's value chain, including supply chain activities, product transportation, and end-user consumption. Effective carbon accounting and monitoring systems are essential for identifying emission hotspots and developing targeted mitigation strategies. Advances in digital technology, including AI-driven analytics, have significantly improved the accuracy and effciency of carbon measurement and reporting frameworks.

Climate Change Urgency

Climate change has increasingly become a defining global challenge of our time. Scientific evidence indicates that rising concentrations of greenhouse gases in the atmosphere are altering the Earth's climate system, resulting in increased global temperatures, more frequent extreme weather events, and widespread ecological disruptions. The consequences of climate change extend beyond environmental degradation, affecting economic stability, food security, water resources, and human health.The urgency of addressing climate change is reflected in the growing consensus among scientists and policymakers that immediate and coordinated action is necessary to limit global temperature increases. Without substantial reductions in carbon emissions, the long-term environmental and socioeconomic impacts of climate change may become increasingly dif fcult to manage. In this context, technological innovation has become an essential component of climate mitigation strategies. Digital technologies such as AI provide new tools for analyzing environmental data, forecasting climate patterns, and designing adaptive solutions that can help societies respond more effectively to environmental challenges.

Global Sustainability Commitments

In response to the escalating threat of climate change, the international community has established several collaborative initiatives aimed at promoting sustainable development and reducing global carbon emissions. Among the most prominent of these initiatives is the Paris Climate Agreement, which encourages nations to adopt strategies that limit global temperature rise and transition toward low-carbon development pathways.Complementing these efforts are the United Nations Sustainable Development Goals (SDGs), a comprehensive framework designed to address global challenges related to poverty, inequality, environmental sustainability, and economic development. Several SDGs--particularly those related to climate action, affordable clean energy, sustainable cities, and responsible consumption--directly emphasize the need to reduce greenhouse gas emissions and promote sustainable resource management.These global commitments highlight the importance of international cooperation and collective responsibility in addressing climate change. They also underscore the need for innovative technological solutions that can support sustainable development objectives.

Sustainable Approaches

Sustainable development is based on the principle that economic progress should be achieved without compromising the ability of future generations to meet their own needs. Sustainable approaches therefore emphasize responsible resource utilization, environmental protection, and long-term ecological balance. Key elements of sustainable strategies include the adoption of renewable energy sources, efficient energy management practices, circular economy models, and environmentally responsible production systems. These approaches aim to minimize waste, reduce environmental pollution, and optimize the use of natural resources. In recent years, sustainability has become an integral component of organizational and governmental strategies. Many organizations are adopting environmental, social, and governance (ESG) frameworks to guide their sustainability initiatives. When supported by technological innovations such as AI, these approaches can significantly enhance the eff ectiveness of carbon reduction ef f orts.

AI for Climate Solutions

Artificial intelligence is increasingly being recognized as a powerful tool for addressing environmental challenges. AI systems can analyze complex environmental datasets, identify emission patterns, and generate predictive models that support climate mitigation strategies. For instance, AI-driven climate models can analyze historical weather data and satellite observations to forecast future climate trends. These insights help policymakers and researchers develop more effective strategies for disaster management, environmental conservation, and sustainable infrastructure planning. Additionally, AI technologies can facilitate real-time monitoring of environmental conditions, enabling more proactive and data-driven responses to climate-related risks. By combining AI with sensor networks and remote sensing technologies, organizations can create intelligent environmental monitoring systems capable of detecting and responding to environmental changes more eff ciently.

AI Applications for Carbon Reduction

AI technologies are already being applied across various sectors to support carbon reduction initiatives. In the energy sector, AI-based algorithms are used to optimize power generation, forecast renewable energy production, and manage smart grids. These capabilities help improve energy effciency and reduce dependence on fossil fuels.In transportation systems, AI supports intelligent traffic management, route optimization, and the development of autonomous mobility solutions. Such technologies can significantly reduce fuel consumption and emissions associated with urban transportation networks.In industrial manufacturing, AI enables predictive maintenance, process optimization, and energy - effcient production systems. By identifying inefficiencies and reducing waste, AI-driven industrial solutions contribute to lower carbon emissions and improved operational performance.Similarly, AI is transforming agricultural practices through precision farming techniques that optimize irrigation, fertilizer usage, and crop monitoring. These innovations help reduce environmental impact while maintaining agricultural productivity.

Challenges

Despite its considerable potential, the integration of AI into climate action strategies presents several challenges. One important concern relates to the energy consumption associated with large-scale AI models and data processing systems. Ensuring that AI technologies themselves are developed in environmentally responsible ways is therefore a critical consideration. Another challenge involves data availability and infrastructure limitations. Effective AI solutions require high-quality environmental data and robust digital infrastructure, which may not be equally accessible across all regions. Additionally, ethical considerations related to data governance, transparency, and technological inequality must be addressed to ensure that AI-based sustainability initiatives are implemented responsibly and inclusively.

Future Opportunities

Looking forward, the continued advancement of artificial intelligence presents significant opportunities for strengthening global climate action. Emerging research in areas such as green AI, smart energy systems, and digital sustainability platforms is expected to enhance the ef fectiveness of environmental management strategies.The integration of AI with circular economy models, renewable energy technologies, and sustainable supply chains may further accelerate the transition toward low-carbon development pathways. As technological capabilities continue to evolve, AI is likely to play an increasingly important role in supporting sustainable innovation and environmental resilience.

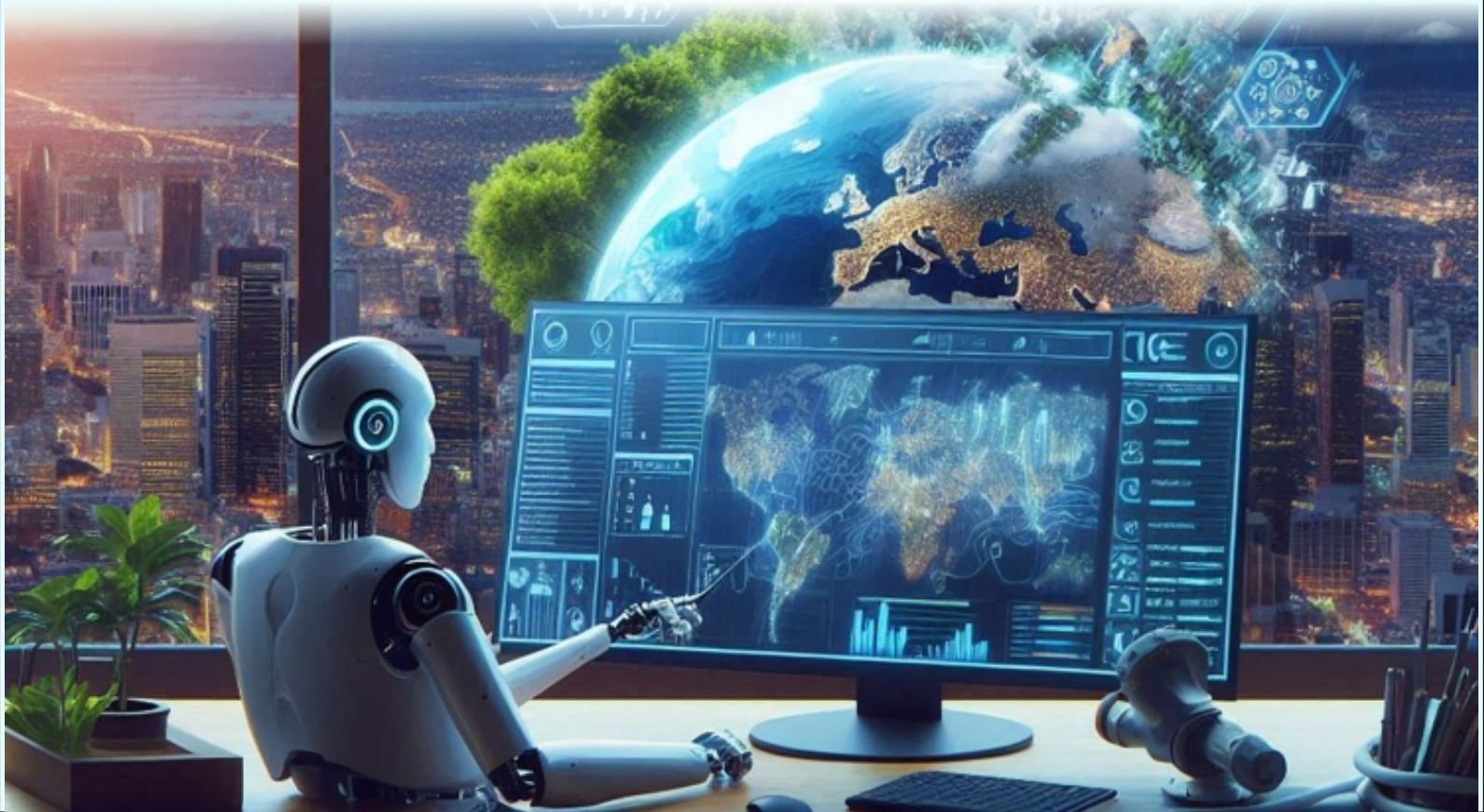
Policy Implications

Realizing the full potential of AI-driven climate solutions requires supportive policy frameworks and collaborative governance structures. Governments can encourage the adoption of sustainable technologies by promoting research and development initiatives, establishing clear carbon reporting standards, and providing incentives for environmentally responsible innovation.Collaboration among academic institutions, industry partners, and international organizations can further strengthen the development and implementation of AI-based sustainability initiatives. By aligning technological innovation with policy support, societies can create enabling environments that facilitate meaningful progress toward carbon neutrality.

The growing urgency of climate change demands innovative approaches that combine technological advancement with sustainable development principles. Artificial intelligence offers powerful analytical and predictive capabilities that can significantly enhance efforts to monitor, manage, and reduce carbon emissions across multiple sectors. When integrated with sustainable approaches such as renewable energy adoption, circular economy practices, and efficient resource management systems, AI has the potential to transform how societies address environmental challenges. However, the successful implementation of AI-driven sustainability initiatives requires careful consideration of energy effciency, data governance, and policy coordination. As the global community continues to pursue pathways toward carbon neutrality and environmental resilience, the synergy between artificial intelligence and sustainable development will remain an essential area of research and collaboration. The contributions presented in this conference volume aim to advance this dialogue by exploring innovative ideas, practical applications, and interdisciplinary perspectives that support the transition toward a more sustainable and low-carbon future.

Organizing Committee Members

"Use technology wisely today to reduce our carbon footprint and protect the Earth for tomorrow."



Content

AI-Enabled ESG Carbon Accounting Framework for SMEs in Emerging Economies: A Study from Sub-Saharan Africa with a Zimbabwean Emphasis

Cosmas Herikanos Tarwa[1], Freedom Feya[2], Gladys Mufanebadza[3]
Reformed Church University, Zimbambe

Abstract
The global transition toward sustainable economic systems has intensified expectations for organisations to measure, disclose, and manage their environmental and social impacts. Environmental, social, and governance reporting has consequently become a dominant mechanism through which organisations communicate sustainability performance and long-term value creation. Despite their central role in economic production and resource utilisation, small and medium enterprises in emerging economies remain largely excluded from formal ESG and carbon accounting systems. Recent developments in artificial intelligence have created new opportunities for improving sustainability data collection, carbon measurement, and reporting efficiency. However, most existing studies on AI-enabled sustainability systems focus on large organizations. This study adopts a qualitative interpretive approach to explore how SMEs in Sub-Saharan Africa, with a particular emphasis on Zimbabwe, understand, adopt, and operationalise AI-enabled ESG carbon accounting systems. A multiple case study design was employed, drawing on semi structured interviews, document analysis, and contextual observations across SMEs in manufacturing, services, agribusiness, and trade sectors. The analysis reveals that AI adoption in SMEs is shaped by organisational learning, contextual constraints, and evolving interpretations of sustainability responsibilities. The study develops an AI-enabled ESG carbon accounting framework grounded in SME realities and demonstrates how AI capability interacts with organisational processes to enhance carbon measurement accuracy, reporting quality, and sustainability oriented decision making. The study contributes to sustainability accounting literature by offering a contextually grounded model suitable for emerging economies.
Keywords: Artificial Intelligence, ESG Reporting, Carbon Accounting, SMEs, Sustainability Accounting, Emerging Economies.

Sustainable Hospital Management Using Artificial Intelligence: A Qualitative Case Study of a Zimbabwean Public Hospital

Beauty Gomendo[1], Cosmas Herikanos Tarwa[2] Freedom Feya[3]
Reformed Church University, Zimbambe

Abstract
Healthcare systems across the world are under increasing pressure to deliver quality services efficiently while managing rising costs, workforce shortages, and environmental sustainability concerns. Hospitals, particularly in developing economies, face challenges such as resource constraints, staff shortages, poor infrastructure, and inefficient management systems. Artificial Intelligence (AI) has emerged as a transformative tool capable of improving operational efficiency, clinical outcomes, and sustainable healthcare management. This article explores how AI can be integrated into hospital management systems to promote sustainability, improve employee performance, enhance patient outcomes, and support strategic decision making. Drawing on hospital management principles and emerging AI applications, the paper proposes a sustainable hospital management model driven by AI-enabled decision systems, predictive analytics, digital workforce management, and smart resource utilization. The study adopts a conceptual and analytical approach grounded in healthcare management theory, sustainability theory, and digital transformation frameworks. The findings indicate that AI-driven hospital management improves efficiency, reduces operational costs, enhances staff motivation through smart workforce systems, and strengthens environmental sustainability. The article concludes that AI-based sustainable hospital management is critical for resilient healthcare systems, particularly in low and middle-income countries, and provides recommendations for policymakers, hospital administrators, and researchers.
Keywords:- Artificial Intelligence, Sustainable Healthcare, Hospital Management, Digital Health Systems, Smart Hospitals

Combating Climate Misinformation: An AI-Powered Framework for Detecting and Countering Greenwashing in Digital Media

Fortune Nyamunda[1], Zvinodashe Revesai[2]
1 - Faculty of Arts, Theology, Culture and Heritage Studies,
2 - ICT Department
Reformed Church University, Zimbambe

Abstract
Greenwashing, the practice of conveying misleading environmental claims, undermines climate action and consumer trust. As corporate sustainability reporting proliferates across digital media platforms, deceptive environmental communication has escalated significantly. Traditional manual fact checking cannot be scaled to monitor thousands of daily sustainability claims. Existing AI misinformation detectors lack domain specific adaptations for corporate environmental discourse. This research develops an AI powered framework for detecting and classifying greenwashing in digital media. We created an annotated dataset of 5,000 environmental claims from social media, corporate reports, advertisements, and press releases. A comprehensive taxonomy adapting the Seven Sins framework identifies seven greenwashing categories. The framework employs multistage architecture combining feature engineering with transformer-based models. Textual, discourse, and visual features capture linguistic patterns and rhetorical strategies. We benchmarked nine machine learning approaches from logistic regression to domain adapted ClimateBERT. The ensemble model achieved 91.2% accuracy, 90.3% precision, and 91.8% recall. Domain adapted ClimateBERT outperformed generic language models by 2.2 percentage points. Feature analysis reveals hedge words, citation absence, and vague terminology as strong predictors. Per category performance ranges from 86.4% for vague claims to 96.5% for outright lying. The framework integrates explainability mechanisms including LIME, SHAP values, and attention visualization. These tools enable media professionals to validate predictions and extract evidence. Practical applications support journalists, regulatory agencies, and consumer advocacy organizations. The framework enables scalable monitoring, automated alerts, and fact check template generation. This research bridges computational methods and media theory while advancing climate communication integrity. Future enhancements include multi modal fusion, cross lingual detection, and real time streaming analysis.
Keywords:- Greenwashing Detection, Artificial Intelligence, Natural Language Processing, Climate Communication, Explainable AI, Sustainability, Digital Media

A Case Study in Generative Edge Al in education and learning

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Abstract
This case study details the design, implementation, and outcomes of "Project Athena," a pioneering initiative at a technological university in South Asia to overcome pervasive challenges in modern education through a novel Generative Edge AI ecosystem. Faced with issues of pedagogical personalization, faculty burnout, digital inequity, and data privacy, the project deployed a hybrid architecture where lightweight generative models operate directly on student and faculty devices, interfacing with on-campus servers for more complex tasks. This paper chronicles the 18-month journey from concept to pilot deployment within the Faculty of Engineering. The findings reveal that this Edge AI approach led to a marked improvement in learning outcomes for academically at-risk students, a significant reduction in instructor administrative burden, and the creation of a more equitable and engaging learning environment. Crucially, the architecture inherently addressed data privacy concerns by keeping sensitive student interactions on-device. This study provides a replicable framework and discusses key lessons regarding hardware limitations, change management, and the evolving role of educators in an AI-augmented classroom.
Keywords:- Generative AI, Edge Computing, Personalized Learning, Data Privacy in Education, Educational Technology, AI Ethics, Differentiated Instruction, Digital Divide

Secure File Storage System with Encryption & Role-Based Access

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Abstract
Secure File Storage System with Encryption and Role Based Access is a Web based application developed to provide highly secure and trustworthy Environment to store, manage and share sensitive digital data. With the exponential growth of cloud services and online data exchange, security threats such as unauthorized access, data leakage and cyber- attacks have become major issues for the individuals and the organizations. The proposed system is beneficial for solving these issues and helps implement hybrid Encryption mechanisms, strong authentication mechanisms and stringent access control mechanisms. The system uses RSA to make sure that keys are generated securely, and AES to encrypt the files of the user before storing them. Multi-Factor Authentication (MFA) the application of One time password (OTP) verification will ensure only those who are authorized to access system. Data integrity is preserved using the SHA-256 hashing which checks if any unauthorized modification has been performed in the file transfer or storage Role-Based Access Control (RBAC) is a feature for the administrations to assign certain access rights to the users, as it restrictions that access to sensitive files or it will be permitted only certain roles. The application is implemented based on the python code for back-end processing and MYSQL for safe storing of database. The system is defined to be scalable and efficient but easy for the user to use along with robust protection of the digital assets. Experimental Evaluation confirms the proposed system has drastically improved the security of data, reduce amount of unauthorized access & increases the overall reliability of the system.

Keyword:- Secure file storage, Encryption, AES Encryption RSA, Role Based Access Control, Cloud Security, Data Protection.

Harnessing Artificial Intelligence for Smart Cities and Sustainable Urban Planning in Africa: The Zimbabwean Perspective

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Abstract
Africa's rapid urbanisation presents significant challenges related to infrastructure provision, service delivery, governance, and environmental sustainability. Artificial Intelligence (AI) has emerged as a critical enabler of smart cities by supporting data-driven decision-making, predictive planning, and efficient urban management. This article examines the role of AI in smart city development and urban planning in Africa, with particular emphasis on Zimbabwe. Drawing on recent literature (2021–2026), the study analyses AI applications, opportunities, challenges, and policy implications. The article argues that, when aligned with national development frameworks and ethical governance, AI can contribute meaningfully to inclusive, resilient, and sustainable urban development in Zimbabwe.

Keywords:- Artificial intelligence, smart cities, urban planning, Africa, Zimbabwe, sustainable development

Online Education as a Sustainable Educational Approach in the Digital Era

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Abstract
The rapid digital transformation of the twenty-first century has redefined educational systems across the globe. Online education has evolved from a supplementary learning tool into a central instructional model, particularly following the global health crisis that accelerated digital adoption. Beyond its technological advancement, online education represents a potentially sustainable educational framework aligned with environmental, economic, and social dimensions of sustainability. This paper critically examines online education as a sustainable approach by analyzing its contribution to carbon footprint reduction, resource optimization, and inclusive access to learning. Furthermore, it explores the role of Artificial Intelligence (AI) in enhancing efficiency, personalization, and long-term educational effectiveness. While online learning offers significant sustainability advantages, challenges such as digital inequality, data privacy, and socio-emotional concerns remain critical. The study concludes that online education can serve as a transformative and sustainable educational model when implemented through ethical governance, inclusive policies, and balanced pedagogical strategies.
Keywords:- Online Education, Sustainability, Digital Transformation, Artificial Intelligence, Carbon Emissions, Green Learning

ESG and Carbon Reporting in SMEs: The Role of AI Automation in Harare (CBD), Zimbabwe

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Abstract
The SMEs are the backbone of most economic development and employment in Zimbabwe, in Harare, yet they are still not strongly engaged with Environmental, Social and Governance (ESG) or carbon reporting. National sustainability disclosure requirements and international sustainability reporting standards impose increasing transparency demands on organizations, including SMEs, while at the same time SMEs have continued resource and capacity constraints. This paper explores how the automation of artificial intelligence (AI) can enhance ESG and carbon reporting for Zimbabwe SMEs based in Harare. It seeks to identify the prevalence of ESG and carbon reporting practices currently embedded within these organisations and establish whether such AI powered reporting is aligned with Zimbabwe`s sustainability policy and regulatory landscape, particularly in terms of the National Development Strategy 1 (NDS1), the Environmental Management Act (EMA); and the Zimbabwe National Climate Change Response Strategy (ZNCCRS). Using a qualitative multiple-case study design, data were collected through semi-structured interviews with managers of SMEs, regulators, and sustainability practitioners, and complemented by document analysis. Data were interpreted with thematic analysis. Findings suggest that ESG and carbon reporting are largely informal and compliance-oriented among SMEs. The research reveals that if given the right processes, artificial intelligence enabled reporting improves SMEs' access to international frameworks such as the Global Reporting Initiative (GRI) and the International Sustainability Standards Board (ISSB), despite the typical infrastructure and skills-related limitations of this population.
Keywords:- Artificial Intelligence, ESG Reporting, Carbon Accounting, SMEs, Sustainability Reporting, Zimbabwe, Harare

Bridging Tradition and Technology: The Role of Theological Libraries in Zimbabwe in Integrating Artificial Intelligence to Promote Sustainable Development

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Abstract
This study explores the role of theological libraries in Zimbabwe in integrating Artificial Intelligence (AI) technologies to promote sustainable development while safeguarding theological traditions. Guided by three objectives, the study examines: (1) the role of theological librarians in integrating AI to enhance information literacy and theological education; (2) the impact of AI-enabled library services on teaching, research, and community engagement; and (3) the contribution of theological libraries to sustainable development through ethical and context-sensitive AI adoption. A qualitative research approach using a case study design was employed. Data were collected from 6 librarians and 20 students, through semi-structured interviews and observation. The findings reveal that theological libraries are gradually adopting AI tools such as discovery systems, digital repositories, plagiarism detection software, and AI-supported information literacy instruction. These initiatives enhance access to theological knowledge, research efficiency, and lifelong learning. However, challenges related to infrastructure, AI literacy, ethical concerns, and limited institutional support persist. The study concludes that theological libraries are strategically positioned to bridge tradition and technology and recommends strengthened AI literacy, ethical frameworks, faculty collaboration, and investment in digital infrastructure to ensure that AI integration meaningfully contributes to sustainable development in Zimbabwe.
Keywords:- Theological libraries, Artificial intelligence, Sustainable development, Information literacy, Theology

Leveraging Artificial Intelligence in Disaster Management in Sub-Saharan Africa: The case of Zimbabwe

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Abstract
Sub Saharan Africa is disproportionately affected by natural and human-induced disasters, including floods, droughts, cyclones, wildfires, epidemics, and complex humanitarian crises. Limitations in traditional disaster prediction systems—such as sparse observational networks, delayed data processing, and institutional capacity constraints—have often undermined early warning and preparedness. Recent advances in Artificial Intelligence (AI), particularly machine learning and deep learning, present transformative opportunities to enhance disaster prediction, risk assessment, and early warning across the continent. This paper critically examines the application of AI in disaster prediction in Africa, assessing current use cases, data ecosystems, governance challenges, and ethical considerations. It argues that while AI-driven approaches demonstrate significant potential to improve predictive accuracy and timeliness, their effectiveness depends on data quality, institutional integration, local capacity building, and responsible governance. The paper concludes with policy and research recommendations aimed at mainstreaming AI-enabled disaster prediction as a pillar of climate resilience and sustainable development in Sub Saharan Africa.
Keywords:- Artificial Intelligence, Disaster Prediction, Early Warning Systems, Climate Risk, Africa, Machine Learning

Fake Eco-Certifications Detection Using Computer Vision: A Deep Learning Approach for Combating Visual Greenwashing

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Abstract
Eco-certifications guide consumer purchasing decisions toward sustainable products and services. Fake certification symbols on product packaging exploit consumer trust and undermine legitimate sustainability efforts. Manual verification of certification authenticity cannot scale to monitor thousands of products across retail channels. Existing computer vision systems focus on commercial brand logos rather than regulatory certification symbols. This research develops a deep learning framework for detecting and verifying eco-certifications on product packaging. We created a comprehensive dataset of 10,000 product images containing 50 major eco-certifications and 2,000 documented fake labels. The dataset spans multiple product categories, platforms, and certification types with expert annotation. A multi-stage framework integrates object detection, classification, and authenticity verification. YOLOv8 detects certification symbols achieving 89.7% mAP at 140 FPS. EfficientNet-B4 classifies 50 certification types with 94.3% accuracy. Ensemble methods combining multiple architectures reach 95.7% classification accuracy and 96.8% authenticity verification accuracy. Vision Transformer and ResNet-50 provide competitive performance. Feature importance analysis reveals color accuracy, font consistency, and border sharpness as primary discriminators. Explainability mechanisms including Grad-CAM and SHAP support regulatory enforcement. MobileNet-V3 enables mobile deployment with 45 ms CPU inference time. The framework supports consumer protection, regulatory monitoring, and brand authentication. Practical applications include smartphone apps for point of purchase verification and automated monitoring systems. This research advances visual verification technology while combating greenwashing through fake certification detection. Future enhancements include multi-modal analysis and cross-regional certification coverage.
Keywords:- Eco-certification verification, computer vision, deep learning, object detection, fake label detection, greenwashing, explainable A

A Review on Automated, Energy Efficient Tobacco Curing Systems Using Machine Vision For Quality Guided Control

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Abstract
The tobacco flue-curing process is a complex biochemical process that involves removing moisture from tobacco leaves using heat. The process involves precise temperature management because this is closely related to quality of the leaves. The traditional method is the one that is widely used in Zimbabwe. This method relies mostly on human judgement and it usually leads to inefficient heating which affects leaf quality (TIMB Zimbabwe, 2024). This also has significant impacts on the environment especially in developing countries like Zimbabwe where deforestation is a major concern (Tsuura, 2020). This paper reviews the latest advancements in automated tobacco curing process, particularly through the use of advanced techniques for assessing leaf quality, Convolution Neural Networks (CNN), and Fuzzy Logic Control (FLC) to ensure adherence to environmental standards. We also identify a critical and urgent need for effective affordable solutions that can be used in areas with limited resources to bridge the gap between small scale farmers and precise.
Keywords:- Machine Vision, Tobacco Curing, Deep Learning, Fuzzy Control, Energy Efficient.

Managerial Perceptions of Artificial Intelligence in ESG reporting and carbon accountability: A qualitative study of Zimbabwean corporations

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Abstract
Interest in digital solutions that can increase carbon accountability has increased due to the growing demand for credible environmental, social, and governance (ESG) disclosure on a global scale. Although artificial intelligence (AI) is being marketed as a game-changing tool for sustainability reporting, little is known about how managers in emerging economies perceive its benefits or gauge how prepared their companies are to implement it. This study investigates how managers view AI-enabled ESG reporting in Zimbabwean companies, a setting marked by resource limitations, institutional uncertainty, and voluntary disclosure regimes. The study used thematic analysis guided by the Technology Acceptance Model and Institutional Theory, and it drew on semi-structured interviews with 15 managers from manufacturing, financial services, and agro-processing companies. The findings indicate that managers widely acknowledge AI's potential to enhance data accuracy, reporting efficiency, and forward-looking carbon management. Significant obstacles, such as a lack of technical expertise, fragmented data environments, limited financial capacity, and weak coercive and mimetic pressures from markets and regulators, temper positive perceptions. Adoption attitudes that are cautious are also influenced by governance and accountability issues related to algorithmic decision-making. The study shows that in situations where organisational capabilities and institutional support are still lacking, positive views about the utility of technology alone are not enough to motivate implementation. Using qualitative data from Sub-Saharan Africa, the study broadens the discussion of technology adoption beyond established regulatory frameworks and emphasises how crucial it is to match digital innovation with governance frameworks, skills development, and legitimacy structures. The results have implications for corporate executives, professional associations, and legislators who want to support low-carbon transitions in developing nations and fortify credible ESG systems.

Keywords:- Artificial intelligence, ESG reporting, Carbon accountability, Sustainability, Managerial perceptions, Zimbabwe

Big Data Analytics for Carbon Footprint Assessment and Climate-Smart Decision Making

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Abstract
Climate change has emerged as one of the most critical global challenges of the 21st century. Accurate assessment of carbon emissions and informed climate decision-making require large-scale, real-time, and multi-source data analysis. Traditional carbon accounting methods often fail to capture dynamic emission patterns across sectors. This paper explores the role of Big Data Analytics in assessing carbon footprints and supporting climate-smart decision-making. The study highlights how data collected from satellites, IoT sensors, industrial systems, transportation networks, and environmental monitoring stations can be integrated into analytical frameworks to generate accurate emission inventories and predictive climate models. Furthermore, the paper proposes a conceptual framework combining big data tools, machine learning algorithms, and visualization dashboards to enable policymakers, industries, and urban planners to adopt sustainable strategies. The study concludes that big data-driven approaches significantly enhance transparency, precision, and responsiveness in climate governance.

Keywords:- Big Data, Carbon Footprint, Climate Change, Data Analytics, Sustainability, Decision Support Systems

Leveraging AI for Enhanced ESG Carbon Accounting and Reporting: Opportunities, Challenges and Future Directions

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Abstract
This paper examines the role of Artificial Intelligence (AI) in enhancing Environmental, Social and Governance (ESG) carbon accounting and reporting, focusing on opportunities, challenges, and future directions. As regulatory pressure and stakeholder demand for high-quality climate disclosures increase, organisations face growing complexity in measuring, validating, and reporting carbon emissions across operational and value chain activities. AI technologies offer scalable solutions through automated data capture, anomaly detection, predictive analytics, and integrated reporting systems. The study adopts a qualitative methodology based on expert interviews conducted with sustainability professionals, auditors, financial managers, and regulators in Zimbabwe. A purposive sampling approach and thematic analysis were used to generate insight into current practices and emerging adoption patterns. Findings indicate that AI significantly improves efficiency, data consistency, and analytical capability in carbon accounting processes, particularly through automation of emissions data aggregation and intelligent estimation models. Experts highlighted the value of AI in scenario modelling and forward-looking carbon forecasting linked to strategic planning. However, the results also reveal important constraints, including model transparency concerns, auditability challenges, skills shortages, data quality risks, and reliance on external technology vendors. Governance and assurance implications emerged as central adoption conditions, with explainable models and documented controls viewed as critical safeguards. The paper contributes empirical-style insight from an emerging market context and shows that AI can strengthen ESG carbon reporting quality when supported by appropriate governance, professional capacity, and regulatory guidance. It recommends phased adoption, explainable AI frameworks, and targeted skills development. Future research should extend mixed-method and cross-country analysis of AI-enabled ESG reporting systems.
Keywords:- Artificial Intelligence, ESG reporting, carbon accounting, sustainability analytics, climate disclosure.

An AI-Driven Predictive Navigation System for Dynamic Congestion Avoidance & Urban Idling Reduction

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Abstract
Rapid urban growth across African cities has intensified traffic congestion, resulting in prolonged vehicle idling, increased fuel consumption, and worsening air quality. Conventional navigation systems respond reactively to congestion rather than predicting future traffic conditions. This poster paper presents an AI-driven predictive navigation framework designed to reduce urban idling through proactive congestion forecasting and dynamic routing. Literature on traffic prediction, intelligent routing, and adaptive traffic control is synthesized to propose a scalable framework tailored to African urban environments. The proposed system integrates mobile GPS data, historical traffic patterns, and machine learning models such as Long Short-Term Memory (LSTM) networks to predict congestion and recommend optimal routes. The framework emphasizes low-cost implementation using mobile data and crowdsourcing approaches to overcome infrastructural constraints common in developing cities (World Bank, 2020; UN-Habitat, 2022).
Keywords:- Predictive Navigation, Traffic Congestion Prediction, Intelligent Transportation Systems, Sustainable Mobility, AI Routing, Urban Idling Reduction.

Using AI in Vernacular Architecture for Sustainable Development: The Case of Gond Tribe Dwellings of Central India

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Abstract
Vernacular architecture embodies localized knowledge systems shaped through prolonged adaptation to regional climate, cultural practices, and material resources, offering valuable perspectives for sustainable development. The dwellings of the Gond tribe in Central India serve as a compelling example of indigenous architectural traditions that integrate environmental responsiveness, socio-cultural values. This study examines the application of artificial intelligence (AI) as an analytical framework to assess and reinterpret the sustainability inherent in Gond dwellings. AI-assisted spatial analysis employing space syntax is used to investigate dwelling layouts, materials and courtyard organization patterns of daily activities across selected case studies. The findings reveal that Gond dwellings exhibit intrinsic sustainability characteristics, including improved climatic responses, efficient use of resources, spatial flexibility, and strong social cohesion. The study demonstrates that the integration of AI with vernacular architecture can support sustainable development by informing climate-responsive design strategies, material usage in the preservation of indigenous knowledge systems, and guiding the development of context-sensitive housing solutions. The paper highlights the increasing importance of AI space syntax in analysing, and translating vernacular architectural wisdom for future sustainable built environments.

Keywords:- Sustainable development, AI tool, Spatial analysis, Gond tribe dwellings

An Integrated WQI–GIS–AI Approach for Evaluating Urban River Water Quality: A Case Study of the Gomati River, India

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Abstract
The Gomati River, a major tributary of the River Ganga, serves as a surface water resource for Lucknow city, Uttar Pradesh. Rapid urbanization, untreated sewage discharge, and intensified anthropogenic activities have significantly degraded its water quality. This study evaluates the spatial and seasonal variability of surface water quality of the Gomati River using an integrated Water Quality Index (WQI), Geographic Information System (GIS), and artificial intelligence (AI)–based analytical framework. Surface water samples were collected from 20 different locations along the urban stretch of the river during pre-monsoon and post-monsoon seasons and analyzed for key physicochemical and microbiological parameters following standard methods. WQI was computed to assess overall water suitability, while GIS-based spatial interpolation was applied to visualize spatial patterns and identify pollution hotspots. To enhance data interpretation, a hybrid AI approach combining Principal Component Analysis (PCA) and Random Forest (RF) modeling was employed to reduce data dimensionality, identify dominant pollution-controlling parameters, and improve classification of water quality status. Results indicate a slightly alkaline nature of river water, with elevated electrical conductivity (EC), total dissolved solids (TDS), biochemical oxygen demand (BOD), and chemical oxygen demand (COD) during the pre-monsoon season due to low-flow conditions and concentrated urban inputs. High fecal coliform levels across most monitoring sites render the river unsuitable for direct domestic use. WQI values classify the river water predominantly as poor to very poor during the pre-monsoon season, improving to fair to poor in the postmonsoon period due to dilution effects. The integrated WQI–GIS–PCA–RF framework effectively identifies pollution-sensitive stretches and provides a robust decision-support tool for sustainable urban river management.

Keywords:- Gomati River; Urban river water quality; Water Quality Index (WQI); Artificial intelligence (AI); RS &GIS

AI-Enabled Climate-Responsive Leadership and Sustainable Institutional Transformation: A PLS-SEM Study in Higher Education

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Abstract
The growing urgency of climate change demands that higher education institutions move beyond policy rhetoric toward measurable, technology-enabled sustainability outcomes. Artificial intelligence (AI) presents significant opportunities for carbon reduction, energy optimization, and intelligent resource management; however, its effectiveness depends largely on leadership capacity and institutional governance. This study investigates the role of AI-enabled climate-responsive leadership in driving sustainable institutional transformation in higher education. Drawing on digital leadership and sustainability governance frameworks, the study develops a structural model linking AI integration capability, climate-responsive leadership behaviour, sustainable governance practices, and institutional transformation outcomes. A quantitative research design was employed, with data collected from academic leaders and university administrators. The proposed relationships were tested using Partial Least Squares Structural Equation Modeling (PLS-SEM). Findings reveal that AI integration capability significantly influences climate-responsive leadership behaviour, which subsequently drives sustainable governance practices and institutional transformation. Leadership behaviour partially mediates the relationship between AI capability and sustainability outcomes, indicating that technological adoption alone does not guarantee environmental impact. The model explains a substantial proportion of variance in sustainable institutional transformation, underscoring the strategic role of leadership in aligning AI deployment with climate objectives. The study contributes to educational management literature by empirically integrating AI capability, leadership behaviour, and sustainability governance within a unified quantitative framework. Practically, it provides evidence-based insights for institutional leaders and policymakers seeking to leverage AI as a catalyst for carbon-neutral and sustainability-oriented universities aligned with global development goals.

Keywords:- Artificial Intelligence, Climate-Responsive Leadership, Sustainable Governance, Higher Education, PLS-SEM.

Estimating the Probability of Default (PD) in Zimbabwean Microfinance Institutions: A Logistic Regression Approach

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Abstract
Microfinance institutions in Zimbabwe have problems in screening between good and bad loans. The study sought to establish the major drivers of default risk in MFIs in Zimbabwe. Utilizing a dataset of 540 microloans, the study employs a binary Logistic Regression model. Findings indicate that loan-to-income ratios, business experience, and sectoral allocation (agriculture vs. trade) are significant predictors of default, while traditional demographics (gender, age) are less influential. A number of diagnostic tests were conducted to test the suitability of the listed variables in the model. The regression model developed was found to have a high predictive power (R^2 = 77.9%). Amidst high inflation and currency volatility, identifying credit risk drivers is critical for institutional sustainability. The study recommended quantitative credit scoring, improved loan to income ratio analysis, artificial intelligence technologies, monitoring by RBZ and better debt recovery methods to sustain the microfinance sector.

Keywords: Microfinance Institutions, Probability of Default, Artificial intelligence technologies, Risk Management, Binary Logistic Regression

TextVision Reading App: An AI-Driven, Low-Carbon Reading Tool for Literacy Inclusion of Visually Impaired Students at the University of Ilorin

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Abstract
Inclusive education is pivotal to sustainable development, especially in resource-limited settings such as Nigeria, where visually impaired learners face significant barriers to literacy and lifelong learning. Framed by AI and sustainable strategies to cut carbon footprints, this experimental study assesses TextVision, a researcher-developed, AI-powered, low-carbon reading tool as a digital substitute for resource-heavy, paper-based aids. The aim was to evaluate TextVision's efficacy in boosting reading proficiency among visually impaired students at the University of Ilorin, yielding measurable gains in literacy that promote autonomy, self-reliance, and eco-friendly media practices. The population included visually impaired learners across all University of Ilorin faculties; a purposive sample of 20 ensured representativeness and feasibility. The TextVision Reader app, enabling independent text-to-speech or Braille conversion, anchored a 4-week training program, with pre- and post-assessments tracking progress. Findings showed significant improvements in reading accuracy, fluency, and confidence. TextVision proves effective as a scalable, low-carbon literacy tool. Institutions should integrate such low-cost AI apps into curricula via faculty workshops and developer collaborations. Policymakers must fund green digital technologies supporting SDG 4 (inclusive education) and SDG 13 (climate action). Ultimately, TextVision empowers visually impaired learners, curbs material-intensive dependencies, and advances equitable, low-carbon learning futures.

Personalized E – Learning Course Recommendation System

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Abstract
The growth of digital learning platforms has enabled unique access to educational resources, and at the same time presented a set of challenges related to course findability and decision making on the part of the learner. Given the availability of thousands of courses through myriad institutions and at myriad levels of difficulty, learners are often at a loss to find content that matches their academic goals, their abilities and their preferences. Conventional search mechanisms and popularity based rankings tend not be able to offer substantive personalisation and help founder learner satisfaction and lower course completion rates. The current research outline is aimed at offering a Personalized E-learning Course Recommendation System which would address these shortcomings through intelligent, data-driven recommendations. The system then processes the inputs from users, such as preferred institutions, level of difficulty and expectations of ratings, to provide relevant course recommendations. Natural Language Processing (NLP) techniques are exploited to determine similarity measures between user preferences and the metadata about the courses and hence help in ranking recommendations accurately. Each recommendation provides an overview of important information, i.e. course title, content of skills, descriptive summary and direct access links to facilitate informed decision-making. The system architecture includes a Python compilation at the back-end part along with a funded relational database to perform efficient data processing and retrieval. Instead of relying on real cyclic web scraping or third party application programming interfaces the system uses a curated dataset to simulate realistic recommendation scenarios and thereby guarantee consistency and reliability. Core functional components include user registration, secure authentication and recommender engine able to dynamically adjust based on the input parameters. Experimental results show that the system successfully limits learning options of interest and provides customized recommendation with an improved level of relevance compared to the other filtering methods. The proposed solution serves as a scalable prototype of Intelligent Academic Advisory Systems, thus making a contribution to augmented learner engagement, efficiency and satisfaction in the current E-learning environments.

Keywords:- Personalized e-learning, course recommending systems, natural language processing (NLP), content-based filtering, intelligent education systems.

Smart Campus Placement System Using Machine Learning An AI-Powered Applicant Tracking Approach

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Abstract
The Smart Campus Placement System is a web-based system developed based on the Django framework to modernize, automate, and streamline the recruitment process of the academic institution. It provides a centralized point where members of the students, the placement officers and the recruiting companies interact to minimize the disparity and lack of efficiency in communication prevalent in traditional processes of placement. The system has been used to facilitate some of the main roles in student registration, uploading of resumes, checking of the eligibility, job applications, scheduling interviews and announcement of the results. The recruiters can easily post job opportunities, define the eligibility criteria and view the information of the applicants, and the students are also updated on the perfect opportunities. The system also has a significant quality in the fact that it uses machine learning to suggest job positions that suit the academic background, skills, and past application trends of a student. This provides a smart overlay to the placement process enhancing accuracy and raising the probability of successful matches. The Smart Campus Placement System will be able to increase efficiency, reduce errors, and provide transparency by substituting manual, paper-based with a fully integrated digital solution. It also has a large scale of institutions with high number of students. Comprehensively, the system offers a well-organized and easy to use campus recruitment system and the whole process becomes easier to both the students and employers.
Keywords:- *Campus Placement, Company, TPO, Student, HR, Job Recommendatio*

Artificial Intelligence Applications in Disaster Prediction and Mitigation: Innovations, Challenges, and Future Strategies for Resilient Societies

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Abstract
As climate change intensifies the frequency and severity of catastrophic events, traditional physical models are increasingly supplemented and, in some cases, surpassed by Artificial Intelligence (AI). This paper examines the transformative role of AI in shifting disaster management from reactive response to proactive mitigation. By synthesising vast, multi-source datasets including satellite imagery, IoT sensor networks, seismic data, and real-time social media feeds, AI-driven systems now provide hyper-local, early-warning capabilities for floods, wildfires, and earthquakes with unprecedented precision. The core of this research explores how Machine Learning (ML) and Deep Learning (DL) architectures, such as Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs), identify subtle environmental precursors that elude conventional analysis. Beyond immediate prediction, AI enhances long-term climate resilience by simulating urban vulnerabilities and optimising the design of disaster-resistant infrastructure. Furthermore, the study addresses the integration of Geospatial AI (GeoAI) in streamlining resource allocation and post-disaster damage assessment, which significantly reduces recovery times and economic losses. Despite these advancements, critical challenges remain, including "black box" algorithmic opacity, data scarcity in developing regions, and the environmental footprint of high-compute AI models. This paper concludes that while AI is not a panacea, its integration into global disaster risk reduction (DRR) frameworks is essential for building a climate-resilient future. Strategic focus on equitable technology transfer and human-in-the-loop governance is recommended to ensure these digital tools effectively safeguard the most vulnerable populations.
Keywords:- Artificial Intelligence, Disaster Management, IoT, Machine Learning, Disaster Risk Reduction

DeepHealthNet: Adolescent Obesity Prediction System Based on a Deep Learning Framework

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Abstract
Adolescent obesity has emerged as a critical global health concern due to its association with early onset metabolic disorders and long-term cardiovascular risks. Traditional clinical assessment methods rely heavily on Body Mass Index (BMI) and manual screening conducted by healthcare practitioners, which often fails to capture lifestyle-associated risk indicators in real time. To overcome these limitations, this research proposes DeepHealthNet, a hybrid deep learning–based prediction framework that integrates biometric and behavioral attributes to estimate obesity risk among adolescents. The system employs a two-stage architecture: a Convolutional Neural Network (CNN) for extracting high-level spatial correlations from anthropometric measurements, and a Bidirectional Long Short-Term Memory (BiLSTM) network for modelling temporal lifestyle features, including diet frequency, activity level, sleep patterns, and screen exposure. A hybrid dataset is constructed by combining publicly available adolescent obesity benchmarks with anonymized observations collected through the deployed web interface of the system. Experimental evaluation demonstrates that the proposed framework achieves higher risk classification performance compared to standalone machine learning baselines, delivering accurate early prediction and real-time individualized recommendations. DeepHealthNet is designed as a deployable web application, enabling accessibility in school-based screening environments while enhancing preventive health analytics.
Keywords:- Adolescent obesity prediction, Adolescent obesity, deep learning, CNN-BiLSTM hybrid model, obesity

AI Based Financial Identification Based on Demography & Economic Forming

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Abstract
Financial identification is an essential precondition for access to formal financial services, but in many developing economies many people are still left out of such systems due to poor identification systems that don't take into account the complex world of rural and agrarian communities. This research highlights the proposed development of an Artificial Intelligence (AI) based financial identification model built on the basic parameters of the households which include demographic (age, gender, education, household size) and economic-based farming variables (landholding size, crop yield, income stability, market availability). Multiple machine learning models like Logistic Regression, Random Forest, SVM and Neural Networks are used to classify the financial inclusion status using the help of standard performance measures. Results have shown that AI precipitated models fares much better than traditional ways that could capture non-linear associations among demographic and agricultural datasets. The most high performing models are neural networks with education, size of landholding, consistency, and proximity to markets being the most important factors. Integrating farming data enables exclusion bias to be minimized and identification of financially able persons who are typically lost by the conventional systems. The research also emphasizes on the ethical value of privacy, fairness and transparency in AI application. Overall, the proposed framework is a way of aiding responsible financial inclusion initiatives especially in underserved rural economies.

Adoption of Artificial Intelligence Tools & Sustainable Management Practices in Kwara State Universities: Implications For Smart City Development

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Abstract
This study examined the relationship between artificial intelligence (AI) tool adoption and sustainable management practices in universities and their implications for smart city development in Kwara State, Nigeria. The study was motivated by the increasing role of emerging technologies in promoting institutional efficiency, environmental sustainability, and smart development initiatives within higher education systems. A correlational research design was adopted for the study. The population comprised university staff in Kwara State, from which a sample of 334 respondents was selected. Data were collected using a structured questionnaire and analysed using descriptive statistics (mean and standard deviation) and Pearson Product-Moment Correlation (PPMC). Findings revealed that AI-driven sustainable management practices were perceived to be high, with a grand mean of 3.07, indicating that respondents believed AI initiatives significantly contribute to innovation, environmental sustainability, resource optimization, and improved service delivery. Furthermore, the correlation analysis showed a positive and statistically significant relationship between AI tool adoption and sustainable management practices ($r = 0.223$, $p = 0.001$). This result implies that increased integration of AI tools in university operations enhances sustainability initiatives such as energy management, waste reduction, and data-driven decision-making. The study concluded that AI adoption plays a crucial role in strengthening sustainable management practices in universities and has the potential to support broader smart city development objectives. The study recommended increased investment in AI infrastructure, staff training, and policy frameworks to enhance sustainable institutional practices.

Keywords: Artificial Intelligence, Sustainable Management Practices, Smart City Development, Universities, Technology Adoption.

Multilingual Story Generation & Speech System

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Abstract
The Multilingual Story Generation & Speech System is a revolutionary AI-driven solution that utilizes the Natural Language Processing (NLP) and transformer algorithms to generate coherent and engaging stories based on the keywords provided by the users to the application. The system is intended to take the input keywords and process them with advanced natural language processing methods to remove noise and create a meaningful story through a transformer-based artificial intelligence model. A unique feature of this system is the multilingual support which allows the user to generate and hear the stories in three languages namely English, Telugu, Hindi. The application also included text to speech module which allows the user to hear the voice of the created story in the chosen language, so that the created story is an interactive and accessible mode. To ensure that the system is used the system provides an easy to use login function, and then options of simply entering keywords, a target language and an option for using speech synthesis. The combination of AI writing storytelling with multilingual text-to-speech function makes this project a useful tool for education, entertainment and language learning. The system is implemented in Python programming language in the form of web interface that makes the system easy to use and simple to deploy. This project shows the possibilities of artificially intelligent beings for the creative production of different content of various types and finds the intersection of the comprehension of natural language and storytelling through the generation of multimedia content.

Keywords:-Artificial Intelligence, Financial Identification Machine Learning, Rural Economy, Financial Inclusion, Agricultural data

Early Detection of Alzheimer's Disease Using Cognitive Features: A Voting Based Ensemble Machine Learning Approach

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Abstract
Timely clinical intervention and proper management of the disease depends greatly on early diagnosis of the Alzheimer disease. This manuscript presents Mnemos, a machine learning-driven model that aims at helping to diagnose the presence of Alzheimer early in the disease progression through the combination of cognitive assessment scores and the use of neuroimaging biomarkers. The suggested methodology will focus on a hybrid feature selection approach integrating the Neighbourhood Component Analysis (NCA) with the Correlation-based Filtration (NCA-F), and hence will be able to find the most relevant features that can predict the disease. The characteristic features are then used to train an ensemble classifier based on voting, that is, a collection of machine learning algorithms, such as K -NN, Random Forest, AdaBoost, XGBoost, Naive Bayes, Logistic Regression, and Decision Tree. To evaluate the model, the system uses the magnetic resonance imaging (MRI) data provided by the OASIS dataset, as well as the information about the cerebrospinal fluid (CSF) biomarker, which is provided by the TADPOLE dataset. Empirical evidence shows that the ensemble model has a higher diagnostic accuracy of over 93 percent, and it has better performance than the individual constituent classifier. The system has been deployed through the performance of a lightweight web interface that allows real-time prediction and visualization of the results, which makes it an adequate decision-support tool to be used by healthcare practitioners. Altogether, Mnemos can be seen as the effective and convenient method of the timely diagnosis of the Alzheimer disease.

Keywords:- Alzheimer's Disease, Ensemble Learning, Feature Selection, NCA-F, MRI Biomarkers, CSF Biomarkers, Machine Learning

Agrigenius: The Ultimate Smart Farming App

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Abstract
The advent of rapidly emerging data-based technologies has offered unparalleled possibilities to good decision-making in agriculture, and this is particularly in communities that are vulnerable to climatic fluctuations, resource limitation as well as in insecure markets. The article presents a data-driven intelligent decision-support system of smart farming that combines machine learning and deep-learning techniques to help agronomists make choices on what to grow and how to align it with the financial budget. The suggested technique relies on soil nutrient parameter, environmental factors, and past data of agriculture to generate context-sensitive crop advisories and to anticipate future dynamics of yield and commodity prices. Given the fact that most of the conventional farming advisory system relies more on inert rules or the experience of an expert, the framework emphasizes the use of predictive modelling to alleviate uncertainty in the process of cultivation planning. Ensemble-based machine learning models are used to discover the best crop-species with regard to different agro-climate conditions, whereas sequence-aware deep learning frameworks are used to discover patterns of changes in yields and prices over time. The system is designed to enable any growth capability in terms of deployment or in terms of user correspondence, by providing a digital platform and, as a result, timely access to actionable insights. The analysis shows that smart analytics will be able to augment farming output, optimize resource usage, and improve economic performances of growers. The proposed framework will promote precision-driven and sustainable agricultural practices by emphasizing the use of adaptability and data-driven reasoning as opposed to manual intervention.

Keywords:- Smart Agriculture, Machine Learning, Deep Learning, Crop Recommendation, Yield Prediction, Price Forecasting, Decision Support Systems.

Water Scarcity Management Through Centralized Knowledge-Sharing Platform

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Abstract
Water scarcity has become one of the most serious issues that impact the sustainability of the planet as a whole, as well as the stability of the economy and human survival. Increasing population growth, climate change, fast-paced urbanization, and the inefficient use of water utilization practices have caused any pressure on the limited freshwater resources. Although many regions have independent water management initiatives, the lack of centralized information, coordination and common knowledge has a great impact on its impact. This project brings a creative centralized knowledge- sharing platform for better management of water scarcity by translating real-time historical data, research result, government policies and people's inputs into a platform system. The platform enables the collaboration of prejudice policymakers, researchers, water authorities and citizens, encouraging cultivated decision-making and sustainable water usage. This work proposes a centralized knowledge- sharing platform which is intended to improve the management of water scarcity through access to structured data integration, collaborative knowledge exchange, and access to transparency of water-related information. The platform gathers in one digital ecosystem real-time water availability information, historical data of water usage, research results, policy frameworks, community-driven information. By making it easy for policymakers, water authorities, researchers, and citizens to communicate, the system is making possible sound decision-making and forward planning as well as appropriate water consumption. The platform being proposed also encourages public awareness and participation as they provide timely alerts, conservation guidelines, specifics for a particular region. Its modular and scalable architecture understands the case of adaptation to different geographic administrative situations and allows its deployment in the urban area. On the whole, the idea to centralize knowledge- sharing approach is filling in the critical gaps in the traditional water management system and contributing to a system of sustainable water governance, enhance resource utilization and long-term resilience against water scarcity.

Criminal Evidences Management System Using Block Chain

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Abstract
The Criminal Evidences Management System using Blockchain is designed to overcome the limitation of a traditional centralized evidence management system and these include data tampering, lack of transparency, unauthorised access and loss of evidence. In present systems, proof is often circulated in, and prone to manipulation in centralized databases that are targetable and cyber-subjected, resulting in wrongful convictions, or would let offenders get away with their crimes. To solve these problems, in the proposed system, blockchain technology is employed which offers a decentralized and shameless transparent platform to manage crime evidences. Each evidence record is stored in the form of transaction in the block chain which is secured using the crypt graphic hash functions and time stamped in it. This ensures that after evidence has been recorded it cannot be altered or deleted without detection, which means the integrity and authenticity of evidence may be protected throughout the life of the evidence.
Keywords:- Block chain Technology, Digital Evidence, Proving the Integrity, Digital Forensics, Dear Plan.

A Hybrid Framework for Automated Evaluation of Subjective and MCQ Answer Scripts Using Large Language Models and NLP Techniques

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Abstract
Hand grading of student exam papers is one such undertaking which is very time consuming and prone to error, especially when cumulative amounts of non-uniform documents containing short answers and multiple-choice questions are being tested. The newest developments in large language models (LLMs) have presented new opportunities in automated evaluation that has broken the traditional frames of rule-based approaches. In this study, the researchers offer the hybrid model taking advantage of the LLM to identify and categorize the answers of the students, thus, enabling a delicate comprehension of various orthographic deviations, spelling errors, and formatting peculiarities. After answer recognition, LLM based or classical natural-language-processing (NLP) methods are used to verify the answer depending on the need and the resources available. In the case of multiple-choice questions, scoring is strongly achieved by having stringent criteria, and in other cases, scoring is based on the semantic closeness to the model answer, the system scoring written answers in accordance with established rubrics. The modularity of the architecture is intentional and is easily extensible and flexible to a variety of educational use cases without necessarily requiring an extensive annotated corpus. The empirical case studies show how the system has been tested to reliably read the submissions of students and give reproducible grades over the years, which minimizes the manual burden of grading but does not reduce the transparency and flexibility of the evaluation process.
Keywords:- Automated Answer Evaluation, Large Language Models, Script Recognition, Natural Language Processing, Hybrid Evaluation Framework.

Blockchain Based KYC Model for Credit Allocation in Banking

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Abstract
Strong Know-Your-Customer (KYC) practices benefit financial institutions in the way they do business by making it more difficult for criminals to hide fraud, money laundering or some other illegal scheme. Every different bank generally has its own process for KYC however, connecting those systems together can lead to a version of verification networks that eliminates duplication and saves time. When KYC is on Blockchain the process is even more transparent. A decentralized ledger enables institutions to verify the existence of customer information in near real-time while not compromising on customer privacy. Since blockchain is based on cryptography and tamper-proof records, this means that this provides a secure location for the kept verified data. That means that there are less opportunities for data leaks, and much less paperwork for customers since organizations don't need to keep asking for the same documents several times. This paper introduces a KYC framework that is based on the Ethereum and enables banks to share such important information as the loan limit, collateral information, and risk assessment. With a shared pool of reliable financial data, banks can therefore work together more efficiently, develop tighter networks and plug the security holes that an attacker can exploit (including Sybil-style threats).
Keywords:- Know your customer, blockchain, Ethereum, smart contract, distributed ledger.

Advanced Railway Travel Tracking & Reporting System (IOT)

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Abstract
Railway networks handle tremendous volume of passenger & freight services on daily basis, in which small delay will leads to disruption in working of railway services and decrement in the satisfaction level of the passenger. In many existing railway systems, the update of train status however is often based on fixed schedules or manual reporting, and therefore reacting to unexpected delays or route deviations is often difficult or takes a long time. As the operations of railway get complicated there exists a need for systems that can provide a continuous visibility of the train travel and operational performance. the Advanced Railway Travel Tracking and Reporting System is proposed in order to meet these challenges by providing real-time monitoring and centralized reporting of the data related to train travel. The system uses location information through GPS to keep track of the movement of trains at all times and consists of analysis to find out delays, abnormal stoppage points, and deviation from scheduled routes. Processed information is safely communicated to respective departments of the railway department via a centralised platform To check reports by administrators and keep the schedules updated and take the corrective measures immediately. By upgrading from the periodic updates to the continuous monitoring and the analyses of the data, the proposed system will be creating a higher level of awareness of operations, minimisation of response time and improving the overall reliability and efficiency of railway transportation services.
Keywords:- Railway Travel Tracking Real time train monitoring GPS based tracking of train Railway Delay analysis Travel status Report Transportation Analytics Railway Operation Management Train Movement Analysis

Empowering Women: A Creative Approach to Integrated Safety with Machine Learning Algorithms

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Abstract
Women's safety remains a major global concern that requires proactive and intelligent technological solutions. Safety for women isn't just about apps; it's about building a system that can actually think and react when a second counts. This project introduces a machine-learning- driven web platform designed to bridge the gap between a threat occurring and help arriving. By merging real- time GPS data with user reports and automated alerts, we've created a "responsive safety net." At its core, the application uses supervised learning and anomaly detection to sift through situational data. It's trained to recognize specific behavioral shifts or environmental triggers that point toward danger. Once the system flags a risk, it instantly notifies both emergency contacts and local authorities. Beyond just reactive alerts, the app features live location tracking and predictive warnings to help users navigate their daily commutes more safely. Because the model learns from every new data point, it gets smarter over time—sharpening its accuracy and cutting down on frustrating false alarms. This is a practical, direct attempt to use technology responsibly to protect lives.
Keywords:- Women's Security Frameworks, Applied Machine Learning, Intelligent Risk Assessment, Live Geospatial Tracking, Algorithmic Anomaly Detection, Real-Time Threat Identification

Content-Based Image Retrieval for Super Resolution Images Using Feature Fusion

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Abstract
Content-Based Image Retrieval (CBIR), Video prediction based on last frame prediction are the important modes for efficient management and searching of large-scale visual database especially due to the rising terminologies of high quality and super-resolution images. This project introduces a hybrid CBIR system which is aimed at enhancing the retrieval accuracy by effectively combining deep learning-based semantic features and traditional hand-crafted image descriptors. The proposed approach combines the high level features which are extracted through InceptionV3 (GoogLeNet) model with complementary hand crafted features such as Modified DDBTC, Histogram of Oriented Gradients (HOG), Integrated HSI color channels and Gray-Level Co-occurrence Matrix (GLCM). All images are enhanced via INTER-CUBIC interpolation to support super resolution processing ensuring a better visual quality to extract features for. The evaluation of the system is done on benchmark data sets from VISTEX and STEX with experimental results demonstrating visible improvements with respect to precision, recall and F-measure when compared to deep learning-only retrieval models.

Keywords:- Content Based Image Retrieval, Super resolution Imaging Features Fusion, Deep learning, InceptionV3, Hand crafted features Texture and colour Features

IOT Smart Bag for Women Safety

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Abstract
Women safety has become a popular issue in society due to the rise in cases of harassment and physical attacks both in societal places and at home. Although the modern world is overrun with safety solutions, most of them are based on the usage of smartphones, the ability to connect to the internet, or be turned on manually, which tend to malfunction in the most dire situations. To overcome these constraints, this paper proposes the design and development of an Internet-of-Things (IoT) Smart Bag to provide Women with Safety, which provides emergency-detecting capabilities in the form of automatic alerts and real-time alerts delivery. The suggested system is a combination of an Arduino UNO microcontroller and a MEMS motion sensor, a GPS module, a GSM communication module, a panic button, and local alert systems. The emergency conditions are activated either automatically, via detection of abnormal motion by the MEMS sensor, or manually, via the panic button; when activated, the system will automatically send an SOS message with real-time latitude and longitude location to pre-registered emergency contacts, via the GSM, and activate a buzzer and an LED to draw the attention of nearby people. The system does not require the use of smartphones or internet services hence ensuring that it functions reliably even in low-network or remote locations. Empirical analysis proves that the system provides the timely alerts, correct location tracking, and fewer response, so this safety solution is quite cost-effective and feasible. My example of the Smart Bag is a great way to demonstrate how the IoT enabled embedded systems can positively transform the personal safety of women by automating and communicating in real time.

Keywords:- IoT, Women Safety, Smart Bag, GSM Communication, GPS Tracking, MEMS Sensor, Emergency Alert System.

NeuraKey Personal Based QR Code and Secure Vault

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Abstract
In the recent digital world, traditional identity verification methods that require the use of passwords, tangible physical tokens or documents suffer from a major security, privacy, and usability challenge. Neura-Key presents a unique mobile-first platform where the human palm would be converted to a safe touchless digital key to get over these restrictions. How to achieve high-accuracy, real-time biometric authentication using distinct palm features There are 2 typical smartphone cameras to capture the images and use deep learning techniques, Transfer Learning (MobileNetV2) to process them. Device-independent digital identity solution Neura-Key merges computer vision, deep learning, encryption, and clean architecture, all to provide a digital identity solution. It is very helpful in places such as healthcare, finance, digital identity management, and personal safety since it ensures strong privacy, better security, and accessibility of sensitive data. Using this research method for authentication can provide a viable and scalable way to authenticate people in the future, although it is a significant move forward in terms of personal digital security.

Keywords:- Biometric Authentication Palm recognition MobileNetV2

Frequency Regulation Using Aggregated EVs with V2G Capability

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Abstract
The rapid integration of renewable energy sources has significantly reduced system inertia, resulting in increased frequency deviations and operational challenges in modern power systems. Electric Vehicles (EVs), when aggregated and enabled with Vehicle-to-Grid (V2G) capability, can function as distributed energy storage systems to provide fast and flexible ancillary services. This paper investigates the application of aggregated EV fleets for primary frequency regulation. A real-time control strategy based on frequency deviation and State-of-Charge (SOC) constraints is developed to ensure both grid support and user mobility requirements. The aggregated EV model is integrated with a two-area power system framework to evaluate dynamic frequency response under load disturbances. Simulation results demonstrate that V2G-enabled EVs significantly reduce frequency nadir, improve damping characteristics, and decrease reliance on conventional generators. Furthermore, the proposed approach enhances system stability while maintaining battery operating limits. The study confirms that coordinated EV aggregation presents a technically feasible and economically promising solution for frequency regulation in low-inertia power systems.

Keywords: Electric Vehicles, Vehicle-to-Grid (V2G), Frequency Regulation, Aggregator, Smart Grid, Ancillary Services, SOC Control.

Predictive Analytics in Medical ERP Systems: Pathways to Operational Sustainability and Emission Reduction

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Abstract
Healthcare organizations operate within highly complex ecosystems characterized by fluctuating patient demand, resource-intensive clinical processes, and energy-dependent infrastructure. These dynamics often result in overstocking, emergency procurement, underutilized assets, and avoidable carbon emissions. This analytical study examines the role of predictive analytics in Medical Enterprise Resource Planning (ERP) systems as a strategic pathway toward operational sustainability and measurable emission reduction. The research evaluates how machine learning–based forecasting models, demand prediction algorithms, and real-time data integration can enhance core ERP modules, including procurement, inventory management, logistics, asset utilization, and energy monitoring. By embedding predictive intelligence into planning functions, hospitals and medical supply networks can anticipate patient inflow, optimize stock levels, reduce pharmaceutical waste, and streamline distribution cycles. The study further incorporates carbon accounting metrics within ERP dashboards to quantify direct and indirect emissions associated with supply chain operations, storage, and facility energy use. Analytical modeling demonstrates that predictive demand planning reduces redundant procurement and minimizes high-emission emergency logistics, while optimized scheduling improves equipment efficiency and lowers idle energy consumption. The integration of sustainability indicators into ERP decision-support systems transforms traditional administrative platforms into proactive environmental governance tools. The findings suggest that predictive analytics–driven ERP systems can serve as scalable digital infrastructures for aligning healthcare efficiency with climate objectives. By connecting operational intelligence with carbon performance measurement, medical institutions can achieve cost optimization, regulatory compliance, and long-term environmental resilience within an increasingly carbon-constrained global economy.
Keywords: - Predictive Analytics, Medical ERP Systems, Operational Sustainability, Emission Reduction, Healthcare Supply Chain Optimization

Scrapping Data from Google Maps Using Python

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Abstract
Google Maps contains a vast amount of location-based information such as business names, addresses, ratings, reviews, contact details, and geographic coordinates. Scraping data from Google Maps using Python enables the automated collection of this information for analysis, research, and application development. This project focuses on extracting structured data from Google Maps using Python-based tools and libraries such as Selenium, BeautifulSoup, and Requests. The scraping process involves simulating user interactions, handling dynamic web content, and parsing HTML elements to retrieve relevant location details. The collected data can be stored in formats like CSV or databases for further processing and insights. This approach helps in market research, business intelligence, location analysis, and decision-making while emphasizing ethical scraping practices and adherence to website usage policies.
Keywords:- Google Maps, Web Scraping, Python, Selenium, BeautifulSoup, Location-Based Data, Business Information, Data Extraction, Automation, Data Analysis

Revolutionizing Agriculture: Machine and Deep Learning Solutions for Enhanced Crop Quality and weed Control

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Abstract
One of the greatest challenges facing agriculture sector is the potential of weed infestation which has severely reduced the quality of food and crop production and as well increase the labour and cost of chemicals. The conventional methods of weed control have made use of manual inspection and blanket application of herbicides that have been very inefficient and caused environment pollution. This paper introduces a smart weed detection system, which consists of classical image processing, machine learning, deep learning and real-time object detection algorithm to improve the accuracy and reliability of the weed detection system. The proposed system employs techniques of image preprocessing such as gray scale conversion and elimination of background, etc. to enhance feature extraction. A hybrid prediction model is adopted, which involves random forest classifier with deep learning model using handcrafted feature-based Random Forest classifier and combination their results is done through voting mechanism for enhance the robustness of classification results. Moreover, an object detector based on YOLOv8 is included which facilitated in identifying weed involved cases in agriculture photographs with great accuracy to intervene in this domain. This system is implemented with the help of a secure web-based interfacing with the help of which, users can upload field pictures and get detailed visual and textual feedbacks. According to experimental results, the combined method is able to enhance the performance of weed detection and is useful for precision agriculture by reducing the quantity of herbicides. and helping to achieve sustainable crop control.

Keywords:- Precision agriculture, Deep Learning, weed detection, Machine learning, YOLOv8, Smart farming.

Design of Intelligent Cloud based Remote Electricity Metering & Billing System

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Abstract
The Design of Intelligent Cloud Based Remote Electricity Metering & Billing System is a comprehensive IoT based solution developed with the concept of Arduino microcontrollers, GSM technology as well as the concept of cloud computing for modernizing, automating and streamlining the electricity metering & electricity billing processes of the utility companies and of the residential consumers respectively. This system provides a centralized platform in which utility providers, consumers and field technicians can interact with each other in order to reduce the disparity and lack of efficiency in energy monitoring that exists in traditional across meter reading processes. The system provides for significant roles like remote meter reading, automatic bill generation, real time monitoring of energy consumption, SMS related notifications and remote-control operations for the devices using GSM communication.

Keyword: - Smart Metering, Cloud Computing, IoT, Arduino, GSM Billing, Energy Monitoring, Machine learning, Remote Meter Reading., IoT., Smart Metering., Cloud Computing.

Blockchain Based Data Integrity Verification for Large-Scale IoT Data

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Abstract
Protecting the accuracy and reliability of the large scales of data coming from IoT devices and being stored in cloud platforms became an important research focus. Many of the available methods involve the use of encryption techniques and trusted Third-Party Auditors (TPAs), and there is often an accompanying trust, cost and scalability concern. Although blockchain-based solutions remove the dependency on TPAs, they also usually introduce a large amount of communication and computation overhead thus making them less practical in massive IoT environments. To overcome these challenges, this work presents a data integrity framework which combines block chain technology and the bilinear mapping, called BB-DIS. The proposed way of doing it is by splitting IoT data into small pieces and creating homomorphic verifiable tags (HVTs), which can be used to perform efficient integrity checks by sampling. Bilinear mapping is used within transactions of the blockchain platform to be able to assure correct and secure proofs of the data stored. There are a prototype of the system, its performance is evaluated in terms of security, data flexibility, computational cost and applicability in the real world. Experimental results obtained using Hyperledger Fabric proves that BB-DIS achieves the improvement of verification efficiency, and at the same time, it completely eliminates the verification of the third party trusted auditors.
Keywords— Data integrity verification, Block Chain technology, Bilinear mapping, Internet of Things.

A Hybrid Deep Learning Model to Predict High-Risk Students in Virtual Learning Environments

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Abstract
Identifying students having problem academically at an early stage is important for support in a timely manner and increasing learning land. In traditional classroom and online learning settings, teachers usually go on factors such as attendance records, grades and personal observations to help teachers identify students who may need help. However, this approach becomes difficult, subjective and inefficient when working with large learner populations, especially in virtual learning environments. To overcome these shortcomings, a hybrid deep learning-based system for the prediction of at-risk students using data on academic performance and engagement information has been proposed in this study. This includes advanced learning architectures, Convolution Neural Networks, Gated Recurrent Procedure, and ResNet1D to capture effective and complex patterns from academic behaviors and sequential engagement patterns. In addition, the method of the Butterfly Optimization Algorithm is use in order to make the selection of the most relevant features in order to enhance the accuracy and reliability of the predictions. Standard evaluation of accuracy, precision, recall are used for evaluation in sustainable virtual learning environments.
Keywords:- High-risk student prediction, Virtual learning environments, Hybrid deep learning, ResNet1D, CNN-GRU model, Sustainable virtual education.

Innovative Vertical Farming System

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Abstract
The IoT Driven Vertical Farming System is an intelligent farming application designed to enhance the productivity of crop on a large scale by way of automation, space utilization and environment monitoring. In traditional agriculture land shortages and climatic changes along with water and power resources wastes are some of the examples of the negative factors that hamper growth, but in contrary to this in case of vertical farming crops can be grown in infinite number of layers upwards by using controlled environment systems inside a building. This system based on IoT based sensors which consisted of soil moisture sensor, DHT11 temperature humidity sensor two type rain drop sensor, light intensity. Monitoring and controlling are done by measurement and detecting the changes in the growth of the plants. The sensor data is crossed with a Node MCU micro-controller that commands the control of irrigation, light and ventilation systems with the help of actuators: pumps, relays, fans, etc. The measurement data is communicated to the cloud services to get displayed in real time and to perform remote monitoring. With ideal environment control the solution reduce the human efforts for intervention while avoid waste of resource as well as improve yield of crop, is a sustainable and scalable solution for urban/ indoor farming solution.
Keywords:- IoT, Vertical Forming, Smart Agriculture, Automation, Environmental Monitoring,

Digital and Computational Approaches for Carbon Footprint Reduction: A Computer Science Perspective

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Abstract
Digital infrastructure has become a material driver of energy demand and greenhouse-gas (GHG) emissions, yet many sustainability discussions focus narrowly on AI optimisation rather than the broader computational stack that powers modern services. This paper develops a computer-science perspective on carbon footprint reduction across the digital lifecycle: software design and algorithmic choices, carbon-aware workload orchestration, IoT architectures for verifiable monitoring, digital twins for predictive optimization, and blockchain-enabled circular economy systems for trustworthy reporting and traceability. We propose a reference architecture, Carbon-Aware Digital Systems (CADS) that couples measurement (energy, carbon intensity, and embodied impacts) with decision policies (temporal/geographical shifting, DVFS, consolidation, and demand shaping) and governance controls (auditable metrics and disclosure readiness). The methodology blends design science research with simulation and literature-grounded quantitative synthesis. Using results reported in carbon-aware scheduling studies and industry frameworks, we show that temporal or geographical shifting in distributed systems can reduce per-task emissions on the order of 10–20%, while software-level refactoring, data minimization, and algorithmic optimization can reduce energy consumption by tens of percent in suitable workloads. We discuss implementation patterns in Kubernetes and serverless settings, and provide an IoT-to-digital-twin pipeline for high-frequency carbon accounting. The work contributes a coherent systems view and a deployable blueprint for organisations, particularly in resource-constrained contexts seeking to reduce operational digital emissions without sacrificing reliability or user value.
Keywords:- computational sustainability; green software engineering; carbon-aware scheduling; IoT monitoring; digital twins; sustainable HCI; blockchain; data centres.

Person Re-Identification in Railways for Public Safety Using Deep Learning

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Abstract
Railway stations are one of the busiest public infrastructures and thus it is a challenging task to continuously to monitor, and identify suspicious persons. Conventional surveillance systems heavily uses the manual fsurveillance systems and hand-crafted visual features which are not good against the changing illumination, pose change and occlusions. To address such drawbacks, in this paper, Deep Learning-based Person Re-Identification (Re-ID) system for promoting the public safety in railway environment is proposed. The proposed system employs Convolution Neural Networks (CNNs) combined with the transfer learning models such as ResNet50 and Efficient Net to extract the discriminative facial and body information of the footage captured from the CCTVs. These deep features are further classified with the help of machine learning algorithms i.e., SVM and Random Forest are used to give a good identification result for individuals that are under non-overlapping camera views. Metric learning techniques, such as cosine similarity are used to increase the accuracy of matches in a real-life condition. That system integrates the administrative module for the data set management and the model training functionality with a monitoring interface for the real-time video analysis and alert generation. Experimental evaluation shows that Random Forest classifier has better performance in person identification than SVM. The proposed framework decreases the reliance on manual surveillance and enhances the level of identification accuracy as well as scalable solutions to the intelligent railway security systems.

Keywords:- Person Re-Identification, Deep learning, C.V.V.E Surveillance, Railway Security, Convolutional Neural Networks, Transfer Learning

Mobile Cloud Computing: Architecture, Challenges, Security Issues, and Future Research Directions in the Era of AI and Edge Computing

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Abstract
Mobile Cloud Computing (MCC) represents the convergence of cloud computing and mobile technologies, enabling resource-constrained mobile devices to access high-performance computational infrastructure via distributed cloud environments. The rapid proliferation of smartphones, IoT devices, and high-speed mobile networks has accelerated the adoption of MCC across sectors such as healthcare, education, business, and smart infrastructure. Despite significant benefits such as enhanced storage, improved processing capability, and seamless data synchronization, MCC faces persistent challenges including latency, energy consumption, security vulnerabilities, network instability, and interoperability issues. This research paper examines the architecture, advantages, limitations, and emerging technological integrations in MCC. Furthermore, it explores future research directions including AI-driven task offloading, edge-cloud hybrid models block chain based security, and sustainable cloud infrastructure. The study synthesizes literature findings and identifies research gaps for future academic and industrial exploration.

Keywords:- Mobile Cloud Computing, Cloud Architecture, Security, Edge Computing, Task Offloading.

Precision Triage: Using AI to Eliminate Rebound Emissions in Remote Care

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Abstract

Patient travel accounts for ~17% of clinical emissions. While telemedicine reduces this, its impact is often nullified by 'rebound emissions'- a carbon footprint generated when inconclusive remote sessions necessitate follow-up in-person visits. Aim: To evaluate how AI-driven precision triage maximizes carbon reduction by ensuring remote visit sufficiency. Analyzing 25,000 encounters (2024–2026), this study utilized Life Cycle Assessment (LCA) to compare digital energy costs against avoided travel. Statistical Analysis involved T-tests to compare AI-vetted vs. standard telehealth and Logistic Regression ($p < 0.05$) to predict the probability of "rebound" physical visits. AI precision triage reduced diagnostic uncertainty by 22.1% and decreased "rebound" in-person visits by 18%. This resulted in a net saving of 5.4kg CO_2e per urban consultation and 22kg CO2e in rural areas. Digital infrastructure emissions remained negligible, contributing < 0.5% to the total footprint. AI is essential for sustainable healthcare. By improving the 'resolution rate' of virtual visits, it prevents the carbon-doubling effect of redundant travel, ensuring digital transitions result in absolute emission reductions. Institutions should implement AI-driven triage as a core sustainability strategy. Policymakers should incentivize "virtual-first" resolution through carbon credits to reduce Scope 3 transport impacts.

Keywords: Precision Triage, Rebound Emissions, Sustainable Healthcare, AI in Telemedicine, Carbon Neutrality.

The Systems Era of Intelligence: Technical Architectures, Agentic Workflows, and Global Governance of Generative AI (2026)

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Abstract

By early 2026, Generative Artificial Intelligence (GenAI) has transitioned from an era of experimental creative novelty to a foundational infrastructure for the global economy. This paper analyzes the critical shifts in AI development over the past 24 months, focusing on the emergence of State-Space Models (SSMs) as a viable alternative to Transformer quadratic scaling, the rise of autonomous agentic workflows in enterprise settings, and the implementation of mandatory global regulatory frameworks. We argue that the "Systems Era" of AI is defined not by model size, but by the orchestration of multi-modal, agentic, and ethically aligned intelligence.

Integration of Renewable Energy Sources into Smart Grid Systems: Challenges and Solutions

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Abstract
The increasing penetration of Renewable Energy Sources (RES) such as solar photovoltaic (PV) and wind energy into modern power systems presents significant technical challenges due to their intermittent and variable nature. High levels of renewable integration can lead to voltage instability, frequency deviations, reduced system inertia, and power quality issues in conventional grids. To address these challenges, smart grid technologies combined with energy storage systems offer an effective solution for enhancing system reliability and operational flexibility. This paper presents the modeling and simulation analysis of a hybrid renewable energy system consisting of a solar PV array, wind turbine generator, and Battery Energy Storage System (BESS) integrated into a smart grid framework. The proposed system is developed and evaluated under dynamic load and generation conditions to assess its impact on frequency response and voltage stability. Simulation results demonstrate that the incorporation of battery storage significantly reduces frequency deviation and improves transient performance during load disturbances. The study confirms that coordinated control strategies and storage integration play a crucial role in achieving stable and efficient renewable energy integration in smart grid environments.
Keywords:- Renewable energy integration, smart grid, battery energy storage system (BESS), frequency stability, voltage regulation, MATLAB/Simulink modeling.

The Strategic Role of Maritime Bonds in India's Carbon Market: Financing the Blue Economy

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Abstract
The world is cladding in a climate catastrophe, and there is a necessity for novel financing tools to uphold the scaling of ocean dependent carbon seclusion. This paper explores Blue Finance as a transformative approach that manoeuver private sector funding for marine ecosystem revamping and sea-based sequestration of carbon inventiveness by the usage of multiple financial instruments, notably Maritime Bonds. As the ocean imbibes around 25% of annual emissions of carbon dioxide emissions which are anthropogenic, the probability of escalating blue carbon dynamism is a decisive yet unplumbed area of climate change alleviation. This research investigates the organising of Maritime Bonds, risk management frameworks, and standards of performance, using analogous analysis from prevailing green bond markets. This research inaugurates a new triple-layered bond structure that merges blue carbon credits, marine environs services appraisement, and monarchical guarantees. The repercussions show that impeccably destined Maritime Bonds can allure between $50-100 billion in annual investment by 2035, labeling a new perimeter in climate finance outline. The paper concludes with recommendations for regularizing blue carbon accounting scaffolds and budding global regulatory frameworks to ameliorate investor sureness in maritime climate financial instruments.
Keywords:- Blue Finance, Maritime Bonds, Carbon Sequestration, Ocean Economy, Climate Finance, Blue Carbon, Sustainable Investment, Marine Ecosystem Services

Emotion Based MultiTask Approach for Fake News and Rumor Detection Using Transfer Learning

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Abstract
The high rate of development in social networking sites, blogs and online articles has made them become a major source of news to their users across the world. Nevertheless, unless stringent measures are put in place to provide credibility on all such posts, much of this information may be fake news or rumors. These fake news or pseudo stories are quickly disseminated, and are likely to have severe social, political and psychological consequences. This scenario clearly shows that there is an urgent need to detect fake news and rumors with more evidence and efficiency. We label various benchmark fake news and rumor detecting datasets with emotion classes labels in this work through transfer learning. The connection between the legitimacy of a text and the emotion behind it should be examined to show that fake and real news are not the same even within the same category of emotion, which will allow extracting better features. Resting on these findings, we suggest to use a multi-task model that predicts at the same time the emotion and legitimacy of a text. To confirm that emotion-based features are more effective at increasing detection accuracy, we test several deep learning models in multi-task and single-task configurations in single domain and cross-domain setups. According to the experimental findings, our multi-task strategy shows better results in accuracy, precision, recall and F1-score than the classical single-task-based methods, and provides better flexibility on datasets.
Keywords:- Fake News Detection, Rumor Detection, Emotion Analysis, Multi-Task Learning, Transfer Learning, Bertweet.

Artificial Intelligence for Municipal Solid Waste Optimization: A Case Study of Smart City Initiatives in Indore, India

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Abstract
India generates an enormous amount of garbage every year, and the majority of it is not handled properly. The rest is dumped in the open, thrown in rivers, or burned on roadsides. Cities are growing fast. The systems managing their waste are not keeping up. Indore, a city in Madhya Pradesh, is a rare exception. It has been ranked as India's Cleanest City for seven years in a row. It got there by combining Global Positioning System vehicle tracking, smart dustbin sensors, Artificial Intelligence-based route planning, and serious community involvement. But technology was not the main reason it worked. Strict rules, consistent enforcement, and years of public engagement made the difference. This paper studies how Indore built its waste system and why it succeeded where other cities failed. The findings are drawn from published research, government reports, and city-level performance data. The paper ends with recommendations connected to the United Nations Sustainable Development Goals, particularly Sustainable Development Goal 11 on sustainable cities and Sustainable Development Goal 12 on responsible resource use.
Keywords:- Artificial Intelligence, municipal solid waste, Indore, smart city, Internet of Things, route optimization, circular economy, Sustainable Development Goals

AI-Assisted LCL Filter Design for Medium Power Grid-Connected Inverters under THD and Stability Constraints

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Abstract
In order to reduce total harmonic distortion (THD) and attenuate high-frequency switching harmonics, a grid-connected inverter's LCL filter is essential. This guarantees that the current fed into the grid satisfies harmonic norms and quality criteria. To ensure compliance with grid standards, THD restrictions must be taken into consideration while building such filters. This paper treats THD compliance as a major design constraint and proposes a systematic technique for creating LCL filters in grid-connected inverters. This method is ideal for medium-power inverter applications because it avoids the need of extremely high switching frequencies, which minimize switching losses and lessen thermal stress on semiconductor components. The design procedure mostly concentrates on the controller's stability requirements and the practical constraints of the filter's component parts. This approach calculates the inverter-side inductance from the permitted peak-to-peak ripple current, and the grid-side inductance based on the acceptable THD level of the grid current. The permissible power factor fluctuation is then used to choose the filter capacitor. The current controller operates steadily thanks to the selected LCL filter settings since the resonance frequency to switching frequency ratio stays within reasonable bounds. A 200-kW grid-connected inverter and PLECS simulations were used for hardware-in-the-loop (HIL) testing to verify the concept. With the measured THD of the grid current nearly matching the desired value of around 2%, the results validate that the system conforms with IEEE 519 requirements.

Green Artificial Intelligence and Carbon Footprints: Towards Sustainable AI Practices

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Abstract
Global automation is being propelled by the quick development of artificial intelligence (AI), however there are urgent environmental issues due to its spiking energy requirements and carbon emissions. In order to reconcile AI's expansion with sustainability objectives, this article suggests a Dual-Circular AI Sustainability (D-CAIS) architecture that prioritizes both sector-wide exterior emission mitigation and internal energy optimization. This study examines how AI can both contribute to and mitigate the effects of climate change, with a particular emphasis on how it can lower carbon footprints in a variety of industries. More effective resource utilization and a decrease in releases of greenhouse gases are made possible by AI approaches including adaptive energy management, supply chain optimization, predictive maintenance, and smart mobility. Additionally, model reduction, green neural frameworks, and carbon-aware scheduling—all AI-driven optimizations in their own development—are revolutionizing the design and implementation of AI systems with negligible environmental impact. AI has the potential to be a potent facilitator of worldwide decarbonization initiatives by being incorporated into climate strategies and encouraging the development of energy-efficient AI. The main developments, difficulties, and avenues for utilizing AI for a more carbon-conscious and sustainable future are highlighted in this study.

Attribute-Based Management of Secure Kubernetes Cloud Bursting

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Abstract
In modern cloud computing, the need for flexible and scalable orchestration of services, combined with robust security measures, is paramount. In this paper, we propose an innovative approach for managing secure cloud bursting in Kubernetes, combining Attribute-Based Encryption (ABE) with Kubernetes labeling. Our model addresses the challenges of complexity, cost, and data protection compliance by leveraging both Kubernetes and ABE. We introduce an attribute-based bursting component that uses Kubernetes labels for orchestration, and an encryption component that employs ABE for data protection. This unified management model ensures data confidentiality while enabling efficient cloud bursting. Our approach combines the strengths of label-based orchestration with fine-grained encryption, providing a technologically advanced yet user-friendly solution for secure cloud bursting. We present a proof-of-concept implementation that demonstrates the feasibility and effectiveness of our model. Our approach offers a unified solution that complies with security and privacy laws while meeting the needs of contemporary cloud-based systems.

Keywords:- Role based access control, policy enforcement, Security policies, environmental attribute.

Artificial Intelligence for Carbon Footprint Reduction in Smart Cities

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Abstract
Rapid urbanization and increasing energy consumption have significantly contributed to the rise in global carbon emissions, making sustainable urban development a critical concern. Smart cities are increasingly adopting advanced technologies to address environmental challenges and reduce their carbon footprint. Artificial Intelligence (AI) has emerged as a powerful tool that enables efficient resource management, data-driven decision-making, and sustainable urban planning. AI-based technologies such as machine learning, predictive analytics, and Internet of Things (IoT) systems help monitor and optimize energy consumption, transportation networks, waste management, and building operations. Intelligent traffic management systems reduce fuel consumption and emissions by minimizing congestion, while AI-enabled smart grids and renewable energy integration improve energy efficiency and reduce dependency on fossil fuels. Additionally, AI-powered environmental monitoring systems provide real-time data that supports policymakers and urban planners in developing sustainable strategies for carbon reduction. This study adopts a conceptual approach to explore how AI applications can contribute to reducing carbon footprints in smart cities. It also highlights the potential challenges such as high implementation costs, technological limitations, and data governance issues. The research emphasizes that the integration of AI with smart city infrastructure can significantly enhance sustainability and support global climate goals. Overall, Artificial Intelligence offers innovative solutions for creating low-carbon, energy-efficient, and environmentally sustainable urban environments, ultimately improving the quality of life for urban populations while promoting responsible environmental stewardship.

ESG Greenwashing Detection in Corporate Disclosures Using Transformer-based Models

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Abstract
Environmental, Social, and Governance (ESG) reporting has become a central mechanism through which corporations communicate sustainability efforts to investors, regulators, and the public. However, the rapid growth of ESG disclosures has been accompanied by increasing concerns about greenwashing—misleading, exaggerated, or unverifiable claims regarding environmental and social impact. This study develops an automated Natural Language Processing (NLP) framework to systematically analyze corporate sustainability disclosures and detect potential greenwashing at scale. We process sustainability reports and 10-K annual filings from major corporations using a multi-stage pipeline that includes sentence extraction, ESG pillar classification (Environmental, Social, Governance), sentiment analysis, extractive summarization, and a novel measurable-versus-vague classifier designed to identify unsubstantiated commitments. A transformer-based BERT variant fine-tuned on ESG-domain text performs sentence-level pillar classification, while a FinBERT-based model captures financial sentiment. To address the length and complexity of ESG reports—often exceeding 20,000 words—we implement a transformer-based summarization model (DistilBART/BART-CNN) that generates document-level, pillar-specific, and section-level summaries. Our results reveal consistent communication patterns: most ESG sentences exhibit neutral sentiment, reflecting descriptive reporting, while approximately 25–30% are classified as vague or unverifiable. These sentences frequently rely on aspirational language without quantitative evidence, serving as potential indicators of greenwashing. The proposed framework demonstrates how NLP techniques can improve transparency, enable scalable auditing of sustainability claims, and support greater accountability in corporate ESG reporting.
Keywords:- sustainability reporting, greenwashing detection, sentiment analysis, transformer-based models, text mining.

Genetic Causes of Glioma: New Challenges & Treatment

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Abstract
Gliomas are the most common primary tumors of the central nervous system and demonstrate remarkable genetic heterogeneity. Advances in molecular genetics have transformed glioma classification, diagnosis, and treatment. Mutations in genes such as IDH1/IDH2, TP53, EGFR, ATRX, and chromosomal 1p/19q co-deletion play crucial roles in tumor development and prognosis. Despite improvements in surgery, radiotherapy, chemotherapy, targeted therapy, and immunotherapy, glioma treatment remains challenging due to tumor heterogeneity, therapy resistance, recurrence, and the blood–brain barrier. This paper reviews genetic causes, molecular mechanisms, treatment strategies, emerging technologies, and future research directions.
Keywords: Glioma, Brain Tumor Genetics, IDH Mutation, Precision Medicine, Targeted.

Integrating Artificial Intelligence in Science Education for Zimbabwean Primary Learners with Hearing Impairment: Opportunities and Challenges

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Abstract
A number of factors affect global sustainable practices. One of the major issues is inclusive educational practices which impact on adequate Science Education knowledge base for sustainability. The 2030 Agenda for Sustainable Development adopted 17 world Sustainable Development Goals whose fourth goal is to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all." However, Science education for learners with hearing impairment (LWHI) in Zimbabwean primary schools remains severely constrained by communication barriers, limited instructional resources, and acute specialist teacher shortages. This compromises their ability to understand sustainability issues like global warming. Thus, this paper examines the opportunities and challenges of integrating Artificial Intelligence in primary science education for LWHI in Zimbabwe to achieve long term environmental impact. AI-enhanced tools including Zimbabwean Sign Language avatar systems, adaptive learning platforms, visual simulations, automated captioning, and multimodal content delivery are identified as significant opportunities for improving science learning accessibility and achievement among primary LWHI. Persistent challenges including infrastructural deficits, absence of Zimbabwe Sign Language (ZSL) specific AI tools, limited teacher digital literacy, inadequate policy frameworks, and ethical data governance concerns are critically examined. The AI-Enhanced Inclusive Science Education (AISE) Framework is proposed as a three-layer contextually responsive model grounded in Universal Design for Learning and human-centered design principles to guide equitable and sustainable AI integration in Zimbabwean primary LWHI education settings. Findings contribute to the broader discourse on inclusive education technology in sub-Saharan Africa and establish priority directions for future empirical research.
Keywords:-Artificial Intelligence, Learners with Hearing Impairment (LWHI), Science Education, Zimbabwean Sign Language, Inclusive Education, Universal Design for Learning, Multimodal Learning.

AI-Based Healthcare Monitoring Through Piezoelectric Materials Via Physical Movement

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Abstract
Artificial intelligence (AI) is gradually advancing the modern healthcare, especially when it is integrated with smart piezoelectric materials for continuous health monitoring applications. Piezoelectric sensors convert simple body movements—such as heartbeats, breathing patterns, walking, or muscle activity—into small electrical signals that can be measured and analyzed. Since these materials generate signals directly from natural motion, they are especially suitable for wearable and portable healthcare devices that require minimal external power. In recent years, improvements in flexible piezoelectric materials and device engineering have enhanced sensitivity, mechanical strength, and signal reliability. At the same time, AI-based methods, including machine learning and deep learning techniques, allow real-time processing of sensor data, supporting noise reduction, feature identification, and early detection of potential health issues. When combined with wireless systems and cloud-based platforms, these technologies enable effective remote monitoring and telehealth support. Although substantial development has been made, challenges like long-term material durability, motion-related signal disturbances, and data privacy still required attention. Future systems are projected to integrate intelligent sensing with AI analytics to provide more precise and personalized healthcare solutions.

AI-Enabled Sustainable Design of an Interleaved High-Gain DC–DC Boost Converter for High Step-Up Renewable Energy Application

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Abstract
High step-up DC–DC converters are key components in modern power electronic systems, particularly in renewable energy applications, electric vehicles, fuel cells, and battery-powered devices where low input voltage must be converted to a higher output level. Conventional boost converters face several limitations at high duty cycles, including increased current ripple, higher switching losses, excessive voltage stress on power devices, and reduced overall efficiency. These issues affect system reliability and energy utilization. To address these challenges, this work presents the design and performance analysis of an interleaved high-gain boost converter using an intelligent and sustainable approach. The interleaving technique employs multiple switching phases operating with phase-shifted control signals, which allows effective current sharing, reduced input ripple, improved efficiency, and enhanced thermal performance. This configuration minimizes component stress and supports long-term reliable operation. An artificial intelligence (AI)-assisted control and optimization strategy is incorporated to enhance system performance under varying load and input conditions. The AI-based method enables adaptive tuning of operating parameters to achieve optimal efficiency and stable output voltage. This approach supports sustainable energy utilization by reducing power losses and improving overall system performance. The proposed converter is modeled and simulated using MATLAB/Simulink to evaluate its characteristics. Simulation results demonstrate higher voltage gain, reduced current ripple, improved efficiency, and better dynamic response compared to conventional converters. The developed system provides an efficient and sustainable solution for high step-up renewable energy power conversion applications.

Mental Health Safety and Depression Detection in Social Media Text Data Based on Deep Learning

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Abstract
Mental health problems, and primarily depression, are too frequently experienced and it is imperative that they are being detected as early as possible in order to avoid severe psychological and social consequences. With the emergence of social media and voice over, people form the habit of expressing their thoughts, feelings and personal experiences online which serves as important indicators of behavioral cues that can signal depressive tendencies. However, manually analysing such vast and diverse sets of data is not practical and time-intensive, which is the reason there is a demand for automating and making such data-driven solutions. The proposed Mental Health Safety and Depression Detection System responds to these challenges, incorporating the text modality and the audio modality to help enhance the predictive performance. RoBERTa for the acquisition of rich contextual embeddings on the textual data and the acoustic and prosodic features such as pitch, intensity, jitter and speech rate from the audio recordings of the user. A weighted ensemble of deep learning and machine learning classifiers such as CNN-BiLSTM, SVM and Random Forest classifiers helps in facilitating the robustness of the classifiers, reduces the classification variance and ensure better generalization with varied users. By combining text and vocal information the system is able to pick out subtle signs of emotion, as well as behavioral irregularities, as well as signs of depression, which come earlier with a superior approach to text-only systems. This above-mentioned automated framework lends support to timely intervention, mental health awareness, and clinically and scaling solution for real-time monitoring of depression.

AI-Based Prediction of Durability Performance and Carbon Footprint Reduction in Green Concrete

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Abstract
The construction industry is almost 39 percent of total global CO2 emissions and Portland cement production is about 8 percent of all man-made greenhouse gas emissions. Green concrete assumes the inclusion of additional cementitious materials (SCMs) (fly ash (FA), ground granulated blast-furnace slag (GGBS), and silica fume (SF)) as a significant potential to decrease the embodied carbon and, at the same time, increase the long-term durability. This non-linear, complicated relationship between SCM type, replacement level, water to binder ratio and curing conditions makes conventional experimental optimisation resource-demanding and time-consuming. This paper presents an ensemble machine-learning model of gradient boosting regression (GBR), artificial neural networks (ANN), support vector regression (SVR), and random forest (RF) to forecast three vital durability measures, including rapid chloride permeability test (RCPT) values, sorptivity, and water absorption, and embodied carbon (EC) estimates. A set of 320 experimental SCM-blended mix designs, including the binary and ternary SCM combinations at 10-60 replacement level, was used to train and validate the model using a 70:15:15 training-validation-test split. The GBR model had a better predictive performance with RCPT with R2 =.976 and RMSE =.3.21 Coulombs Coulombs, sorptivity with R2 =.968, and embodied carbon with R 2 =.989 and RMSE =.124 kg CO2 -1m3. The SHAP (SHapley Additive exPlanations) analysis selected the water to binder ratio and GGBS dosage as the most effective predictors. The model-guided optimisation showed that binary mixtures of FA+GGBS can lower the embodied carbon by up to 38.4 percent and have extremely low chloride permeability. It was reported that optimisation of FA+GGBS binary mixtures can produce very low chloride permeability mixtures (less than 1000 Coulombs) and reduce the embodied carbon by up to 38.4 percent. The suggested framework is a scalable and interpretable green concrete mix decision support tool to support sustainable green concrete mix design based on UN SDG 9, 11, and 13.
Keywords: Green concrete, supplementary cementitious materials, machine learning, RCPT, sorptivity, embodied carbon, gradient boosting, SHAP, sustainability.

AI-Enabled Framework for Intelligent Dielectric Resonator Antenna Systems

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Abstract
This paper represents the design and simulation of rectangular dielectric resonator antenna for artificial intelligence enabled 5G new radio applications. This antenna operates at the n-79 band with a center frequency of 4.5GHz. This front-end device will support broadband internet and fixed wireless access, offering low latency and highly reliable communication, which is particularly useful for automation, robotics, and secure sensor networks. This study highlights the potential of combining conventional DRA Design with an AI-driven system for 5G networks.
Keywords- Dielectric resonator antenna, beam steering, microstrip feed.

Role of Conventional Materials in Reducing Carbon Footprint in Construction

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Abstract
The construction industry is a major contributor to global carbon emissions due to the large-scale use of energy-intensive materials such as cement, steel, and processed construction products. Reducing the carbon footprint of construction activities has become essential for achieving sustainable development. One practical approach is the effective utilization of conventional and locally available construction materials that require relatively lower energy during production and processing. This study explores the potential of traditional construction materials such as lime, clay bricks, natural stone, timber, and locally available aggregates in reducing the environmental impact of building construction. These materials have been widely used in traditional structures and generally possess lower embodied energy compared to many modern construction materials. The research evaluates their environmental advantages, availability, and suitability for integration with contemporary engineering practices. The paper also highlights the importance of using locally sourced materials to minimize transportation-related emissions and promote regional sustainability. A comparative assessment of carbon emissions associated with commonly used construction materials is discussed to demonstrate the environmental benefits of conventional alternatives. The study concludes that the appropriate use of conventional materials, combined with improved construction techniques and sustainable design strategies, can significantly contribute to reducing the carbon footprint of the construction industry while maintaining structural performance and cost-effectiveness.

Keywords: Carbon footprint, sustainable construction, conventional materials, embodied energy, green building, civil engineering.

Technical and Economic Feasibility Analysis of a Mass Rapid Transit System (MRTS) Bareilly: A Transition toward Metrolite

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Abstract
Bareilly, a critical Tier-2 "Counter-Magnet" city in the National Capital Region (NCR), faces significant urban congestion due to rapid population growth and a high volume of intermediate public transport (IPT). This paper evaluates the feasibility of an integrated Metro Rail project—specifically a Metrolite system—aimed at optimizing urban mobility. The study analyzes two proposed corridors: the North-South Corridor (Railway Junction to Barrier-Two via Satellite) and the East-West Corridor (Jhumka Tiraha to Rohilkhand University). By integrating Traffic Volume Counts (TVC) with Peak Hour Peak Direction Traffic (PHPDT) projections for 2041, the research assesses the viability of a 22–25 km network. Engineering constraints, including the narrow Right-of-Way (RoW) in the Kutubkhana-Kohadapir stretch and height restrictions in the Air Force "Funnel Zone," are critically examined. The findings suggest that a light-rail model offers a superior Benefit-Cost Ratio (BCR) compared to conventional heavy metro, providing a sustainable solution to Bareilly's transit challenges while stimulating Transit-Oriented Development (TOD) along the arterial Pilibhit and Rampur roads.

Keywords:- Metrolite, Urban Engineering, Feasibility Study, PHPDT, Bareilly Urban Mobility, Transit-Oriented Development (TOD).

Present and Future AI in Renewable Energy Integration

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Abstract
The role that renewable energy play in reducing climate change is among the most compelling arguments for adopting it. When generating energy renewable energy source like solar, wind and hydroelectric power emit little to no green house gases in contrast to fossil fuels. Initially we performa the thorough analysis of artificial intelligence application related to renewable energy. Next, we present a thorough analysis of renewable energy factories and assess their suitability along with a list of the most widely used and appropriate AI algorithms. This paper comprises an extensive review of the several AI techniques used for renewable energy as well as a methodical analysis of the literature for the study of various intelligent system application domains across different disciplines of renewable energy. AI technologies including Machine Learning (ML) algorithm, Deep Learning, Neural Networks and Data-driven optimization techniques. These technologies improve the prediction of renewable energy generation by analyzing weather patterns, seasonal trends and operational data. AI also plays a significant role in predictive maintenance of renewable energy infrastructure by analyzing sensor assets AI models can detect anomalies and predict potential equipment failures before they occur. This study also addressed seeks to highlight how AI-driven technologies can accelerate the transition toward efficient, resilient and environmentally sustainable energy infrastuctures and climate change mitigation.
Keywords:- Artificial intelligence (AI), Machine Learning (ML), Neural Networks, Deep Learning, Data-driven optimization.

Enhancing Accessibility: A Theoretical and Practical Framework for Barrier-Free Landscape Design

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Abstract
This paper explores the theoretical foundations of disability and its critical intersection with physical campus planning, specifically within the context of Rajshree Institute of Management & Technology (RIMT), Bareilly. It establishes a comprehensive framework defining People with Disabilities (PwDs) and identifies the unique challenges faced by Students with Disabilities (SwDs) in navigating the built environment. A primary focus is placed on the outdoor landscape of the RIMT campus, evaluating how landscape design-including pedestrian pathways, green spaces, and transition zones-impacts student mobility. By reviewing the specific needs of SwDs regarding accessibility, safety, usability, and integrated design, this study proposes a shift toward a barrier-free environment. The research provides a platform for identifying infrastructure gaps at the institutional level and offers design recommendations to ensure that the RIMT campus remains an inclusive, equitable, and navigable space for all students, regardless of their physical abilities.
Keywords: people with disabilities (PwDs), barrier free campus; universal design, campus environment; Student with Disabilities (SwDs

Role of Additive Manufacturing in Promoting Environmental Sustainability

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Abstract
Additive manufacturing (AM) creates intricate components directly from digital data by depositing material layer by layer, ensuring high precision while significantly reducing waste. When compared to traditional manufacturing, AM offers a suite of environmental benefits, most notably through optimized raw material consumption and the integration of advanced, "smart" materials. By focusing on minimizing resource waste, energy consumption, and machine emissions, this technology presents a viable path toward industrial sustainability. As global businesses prioritize their ecological footprints, the momentum behind sustainable AM continues to grow. Industry leaders are increasingly tasking their teams with discovering innovative ways to cut waste, enhance the manufacturing environment for the workforce, and utilize sustainable materials—initiatives that have already spurred growth in high-value goods and services. This paper examines the pivotal role of additive manufacturing in establishing a sustainable production ecosystem and identifies twelve key applications where AM drives environmental goals. While AM is already a dominant force in several critical sectors, its ability to help industries meet specific environmental benchmarks makes it an essential tool in the modern manufacturing landscape.

Keywords:- 3D printing, Additive manufacturing (AM), Sustainability, Sustainable manufacturing

Mitigating effects of green synthesized zinc oxide nanoparticles in combating lead stress in the Solanum lycopersicumseedlings.

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Abstract
This study aimed to investigate the stress-reducing effects of green-synthesized nanoparticles on plants under stress. *Solanum lycopersicum* (tomato) plants were exposed to varying concentrations of lead (Pb)-contaminated water (0 to 15 mg L^{-1}) to assess the impact of zinc oxide nanoparticles (ZnO NPs) on Pb absorption and stress mitigation. Pb levels in plant tissues were measured using inductively coupled plasma mass spectrometry. Biophysical and biochemical parameters, including growth, photosynthetic pigments, sugar content, and antioxidant enzyme activities, were analyzed to evaluate the response of ZnO NPs in Pb-stressed mustard seedlings. The green-synthesized ZnO NPs enhanced germination, root and shoot growth, chlorophyll content, and sugar accumulation both individually and in conjunction with Pb. Additionally, ZnO NPs alleviated Pb-induced stress by boosting photosynthetic efficiency and antioxidant enzyme activity. This research highlights the potential of green-synthesized ZnO NPs as a cost-effective, eco-friendly alternative to traditional chemical fertilizers in agriculture.

Keywords:- Green-synthesis; Nanoparticles; Lead stress; Antioxidants;*Solanum lycopersicum*

Ameliorating effects of green synthesized zinc oxide nanoparticles in combating cadmium stress in the *Vigna radiata*seedlings.

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Abstract
This experiment was designed to examine the stress mitigating strategies of green synthesized nanoparticles on treated plants. In this study, moong plants were irrigated with cadmium (Cd)-contaminated water (from 0 to 5 mg L^{-1}) to examine the effect of the application of zinc oxide nanoparticles (ZnO NPs) on Cd uptake and in mitigation of stress. Cadmium concentrations were determined in plant tissue by inductively coupled plasma mass-spectroscopy. Several biophysical and biochemical parameters, such as growth, photosynthetic pigments, sugar content, antioxidant enzymes, etc., were performed to observe the effect of ZnO NPs in the moong seedlings exposed to Cd stress.The green-synthesized ZnO NPs were observed to increase germination rate, root and shoot length, chlorophyll content, and sugar content when given individually as well as in combination with Cd. Furthermore, the green-synthesized ZnO NPs alleviated the harmful effects of Cd-induced stress by up-surging the photosynthetic yield and improving the antioxidant activities. This research work determined the potential role of green-synthesized ZnO NPs, which are a cost-effective and eco-friendly and can be used to replace traditional chemical fertilizers in agricultural practices.

Keywords: Green-synthesis; Nanoparticles; Cadmium stress; Antioxidants; *Vigna radiata*

AI in Environmental Law & Policy-Making: A Legal–Policy Research Paper

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Abstract
Artificial Intelligence (AI) is increasingly influencing governance mechanisms across various sectors, including environmental regulation and policy-making. This research paper examines the role of AI in strengthening environmental governance through improved monitoring systems, predictive environmental modelling, environmental impact assessment (EIA), and regulatory enforcement. The study also evaluates how AI tools may assist judicial and quasi-judicial institutions in handling complex environmental disputes. While AI technologies can significantly enhance transparency, predictive capacity, and administrative efficiency, their adoption raises important legal and ethical challenges. These challenges include lack of transparency in algorithmic systems, accountability gaps, potential data bias, and risks to privacy and public participation. Within the Indian regulatory framework, such issues must be assessed in light of constitutional principles, particularly the right to life and a clean environment under Article 21. Using doctrinal and analytical research methodologies, the paper analyses relevant statutes, policy documents, and judicial precedents related to environmental governance in India. The study further examines international policy approaches to responsible AI governance. The paper argues that AI-driven environmental governance should be integrated within a robust legal framework that ensures transparency, accountability, human oversight, and public participation. It proposes a regulatory model for responsible AI use in environmental policy-making aligned with constitutional values, environmental justice principles, and sustainable development goals.

Integrating Natural Resource Management into Eco-Friendly Hospitality: A Framework for Zero-Impact Restaurant Development

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Abstract
As the global community faces unprecedented environmental degradation, the hospitality sector must transition toward models that offer zero negative impact on the ecosystem. This paper explores the implementation of Natural Resource Management (NRM) within the design and operation of eco-friendly restaurants. Traditionally, the food service industry has placed significant strain on natural resources through high water consumption, energy intensity, and waste generation. This study proposes a "Circular Gastronomy" framework, focusing on three core pillars: Sustainable Infrastructure, Waste-to-Resource Systems, and Hyper-Local Sourcing. By utilizing eco-friendly building materials, solar-integrated energy systems, and advanced gray-water recycling, a restaurant can achieve a neutral environmental footprint. Furthermore, the paper discusses how such establishments can stimulate sustainable rural development by creating secondary job opportunities in organic farming and up cycled resource management. The findings provide a blueprint for a self-sustaining business model that fulfills human necessities without compromising the environmental capital of future generations.

Keywords: Zero-Impact Design, Sustainable Hospitality, Circular Economy, Eco-Friendly Infrastructure, Natural Resource Management (NRM).

Impact of All-Weather Road Connectivity on Agricultural Supply Chains: A Case Study of Rural Clusters in the Bareilly-Rohilkhand Region

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Abstract
Rural isolation in the Bareilly district continues to hinder the economic potential of agricultural communities despite the region's fertile soil and proximity to urban markets. This research investigates how strategic transport planning—specifically the transition from seasonal tracks to all-weather bituminous and CC (Cement Concrete) pavements—directly influences village-level GDP. By analyzing the connectivity between peripheral villages and the Bareilly mandi (market), the study assesses the reduction in "post-harvest loss" and "transportation overheads. The paper integrates Civil Engineering parameters, such as Drainage Density and Pavement Serviceability Index (PSI), with economic indicators like Price Realization per Hectare. Preliminary findings suggest that optimized transport corridors not only stabilize the supply chain for perishable goods but also trigger a shift from subsistence farming to high-value commercial crops. The study concludes with a proposed "Integrated Rural Transport Framework" designed to maximize the economic return on infrastructure investment for regional planning authorities.

Keywords:- Rural Infrastructure, Pavement Engineering, Agricultural Logistics, Bareilly-Rohilkhand, Socio-Economic Development.

Revolutionizing Endangered Species Conservation Through Artificial Intelligence

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Abstract
The conservation of endangered species such as tigers, rhinos, and elephants is increasingly challenged by poaching, habitat loss, and limited real-time monitoring capabilities. With the advent of Artificial Intelligence (AI), new methodologies are emerging that enable continuous tracking, health monitoring, and behavioral analysis of wildlife. This paper explores how AI, through technologies like machine learning, computer vision, sensor networks, and data analytics, can fundamentally transform wildlife conservation efforts. By integrating real-time tracking devices, biometric sensors, and predictive modeling, AI offers conservationists unprecedented insights and decision-making tools that go far beyond the capabilities of traditional methods. This research discusses current AI applications, proposes an integrated system architecture, reviews case studies, and examines challenges and future directions. Ultimately, the paper argues that AI-driven conservation strategies can help protect and manage endangered species more effectively, ensuring their survival for future generations.

Beyond Smart Cities: The Political Economy of AI and Decarbonization in Urban Systems

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Abstract
India's urbanization presents a distinctive decarbonization challenge: 35% of the population concentrated in cities generates 70-75% of national emissions, yet infrastructure deficits and governance fragmentation prevent replication of Western smart city models. This critical analysis examines the relationship between Artificial Intelligence and sustainable urban planning; moving beyond techno-optimistic narratives to assess realistic implementation potential. Empirical findings reveal a counterintuitive inverse relationship between technology spending and carbon reduction outcomes. This analysis identifies five critical findings: (1) technology investment inversely correlates with carbon outcomes; (2) governance structure precedes technology effectiveness; (3) transit infrastructure drives 10-15% maximum reduction potential, exceeding smart systems 1-3% contribution; (4) equity outcomes diverge sharply—technology-first approaches benefit affluent populations while widening inequality, transit-first approaches serve lower-income majorities while reducing emissions; (5) implementation timelines misalign with 2030 climate targets requiring immediate action.The research proposes evidence-based "Parallel Pathway" sequencing: governance consolidation and transit infrastructure simultaneously, followed by smart systems deployment, rather than technology-first approaches that Indian cities cannot afford and governance cannot coordinate effectively. Our focus is to shift from "cities that work" to "cities that breathe".

Keywords: Indian Cities, Urban Decarbonization, Smart Cities, Transit Infrastructure, Governance Fragmentation, Equity

Smart Grids for a Greener India: Aligning AI Integration in Smart Grids with India's Net-Zero 2070

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Abstract
Decarbonizing a coal-heavy generation base and providing dependable access to 200 million underprivileged citizens are two major issues being faced by India's power sector. Although smart grid technology and artificial intelligence are often hailed as revolutionary solutions, this research contends that their successful integration requires significant institutional and financial reforms. It indicates that smart grids can reduce carbon intensity by 15–25% and increase system efficiency, but only if major structural obstacles are addressed. The ongoing financial difficulties of state distribution firms (DISCOMs), fragmented governance across state lines, and a severe lack of internal data science competence are all impeding current deployment. Additionally, there is strong political opposition to technical solutions like demand-side management, especially when it comes to agricultural subsidies. AI is not the main force behind decarbonization, but rather an optimization tool that improves demand forecasting by 5-8% and improves theft detection. A staged, 15-year approach is required for a feasible deployment pathway, which prioritizes utility financial sustainability, establishes consistent data governance, and completes urban smart meter rollouts before adding advanced machine learning analytics. In the end, AI-enabled grids are crucial tools for controlling the fluctuation of renewable energy sources, but they cannot replace the unattractive foundational work of infrastructure upgrade and policy reform. To prevent costly, disjointed failures, policymakers must go beyond their enthusiasm for technology and adopt a strategy based on institutional preparedness.
Keywords:- Smart Grids, Artificial Intelligence (AI), Decarbonization Pathways, Machine Learning (ML), Demand Forecasting,Distribution Companies (DISCOMs).

AI-Powered Carbon Credit Trading: Revolutionizing Climate Finance in International Trade

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Abstract
Despite being a vital tool for reaching Net Zero objectives, the global carbon credit market is still beset by problems with transparency, double counting, and ineffective Monitoring, Reporting, and Verification (MRV) procedures. The function of artificial intelligence (AI) in transforming these systems is examined in this research. Artificial Intelligence (AI) can detect fraudulent activities, anticipate market pricing with high accuracy (R2>0.89), and automate the verification of carbon sequestration by utilizing Machine Learning (ML), Computer Vision, and Natural Language Processing (NLP). The study comes to the conclusion that an AI-integrated carbon market greatly increases market liquidity and investor trust in addition to improving environmental integrity.

Blockchain-Enabled Framework For Transparent Land Lease and Mortgage Management

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Abstract
The land lease and mortgage aspect is a critical area of land administration which is influenced by the ineffectiveness, mediation and danger of abuse which has been raised by the current systems. The digital platforms can possibly offer good storage and accessibility of information but is susceptible to malpractice, individual point failures and two-spending since it has been centralized. Furthermore, it might lead to lack of trust in the system by the users because of the absence of real time validation, transparency and auditability as well as integrity of the system in its entirety in its functionality. This way, the research will suggest a Blockchain enabled application to run the land rentals and mortgages in a transient manner by capitalizing on the characteristics of decentralization, immutability, and auditory nature of the Blockchain technology. The framework gives a safe and unchangeable approach of all documentation of lease and mortgage transactions, the presence of various parties (seller, local government, lending institutions, and the tenants), and the automatic verification, acceptance, and enforcement of the agreement conditions utilizing smart contracts hence reducing the amount of human mistakes and, therefore, the adherence to the terms of the contract. Smart contracts also ensure that it is less probable that the possibility of the probability of the eventuality of the occurrence of a dual spending in conjunction with unlawful change of record will take place and, in this regard, enhance the degree of trust and responsibility with regard to land related financial transaction. The effectiveness of the proposed framework was proven as confirmed by the experiment to advance transparency of the system, efficiency of the operations and data integrity as compared to the traditional systems. A platform that uses a Blockchain forms one of the frameworks and offers a future generation of land management systems and property finance systems as a scalable and transparent platform.
Keywords:- Blockchain, Land Administration, Smart Contracts, Mortgage Verification, Decentralized Security, Fraud Prevention.

SmartStudent: A Machine Learning-Enabled Student Portal for Academic Performance Prediction

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Abstract
The Student Portal is the centralised web based application for the stream lining of the academic management and student performance prediction with the help of machine learning. Integrating Naive Bayes and XGBoost algorithms which is trained on historical marks data with accuracy of more than 93% for XGBoost algorithm. The system has modules for administrators, teachers and students. Administrators can track student and faculty records, as well as track schoolwide performance. Teachers can take attendance, give assignments, upload materials and give messages as well as view the MLbased feedback on student performance. Students are provided access to assignments, access, download materials, view marks and have information on how they are doing. Built using Python and MySQL, the portal is user-friendly and supports real-time interaction to achieve data-driven academic monitoring and identifying the non-performing students at the earliest.
Keywords:-student portal, machine learning, achievement of achieved of the academic performance prediction naive bayes xgbost educational data mining.

The Impact of Social Media Fake News on Public Perception of Sustainability Efforts: A Study in the Indian Context

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Abstract
The expansion of social media has altered public dialogue around sustainability. Nonetheless, algorithmic curation and echo chamber phenomena expedite the dissemination of misinformation, compromising climate initiatives and diminishing backing for environmental legislation. This study replicates a structural equation modeling (SEM) framework utilized in a previous article while introducing three significant extensions: (i) measurement invariance and multi-group analysis contrasting urban and rural respondents; (ii) moderation by media literacy to investigate how critical thinking affects the relationship between exposure to fake news and perceptions; and (iii) a machine learning classification to evaluate the predictive utility of latent constructs in identifying supporters of sustainability initiatives. A dataset of 1000 Indian respondents was analyzed, with latent variables—fake news exposure (FNE), trust in social media (TSM), media literacy (ML), perceived sustainability benefit (PSB), and support for sustainability activities (SS)—assessed by three reflective indicators each. Exploratory and confirmatory factor studies validated the reliability and validity of the measures. Partial Least Squares Structural Equation Modeling (PLS SEM) indicated that exposure to misinformation significantly diminished Public Service Behavior (PSB) ($\beta = -0.61$, $p < 0.001$) and Social Support (SS) ($\beta = -0.51$, $p < 0.001$). Trust in social media enhanced PSB ($\beta = 0.47$, $p < 0.001$) but did not directly influence SS, whereas media literacy mitigated the adverse effects of FNE. PSB significantly forecasted endorsement for sustainability activities ($\beta = 0.81$, $p < 0.001$). Multi-group investigation revealed more pronounced adverse impacts of misinformation in rural regions. A Random Forest classifier attained 81% accuracy in distinguishing between high and low support, with PSB and FNE identified as the most significant characteristics. These findings highlight the necessity for media literacy programs and AI-enabled misinformation detection, in accordance with conference themes promoting artificial intelligence for sustainable development. The ramifications of the policy and potential directions for future research are examined.
Keywords: Fake News; Social Media; Sustainability; Media Literacy; India; Structural Equation Modelling; Machine Learning.

Crop Prediction By IoT Sensor Using Machine Learning

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Abstract
Agriculture is the backbone of the economy of many countries but agriculture faces challenges in predicting suitable crops, due to changing climatic conditions and resource limitation, farmers are often facing. This project is proposing an IoT based smart agriculture system coupled with machine learning based on prediction of crop. The system uses several sensors attached to a microcontroller (Arduino), consisting of a DHT-11 sensor (getting the temperature and humidity), rain sensor (to get the rain pattern occurring) and a voltage sensor (to determine if there is enough power available). Additionally, the wind energy is also used as a renewable energy source to enhance the sustainability of the systems. The data from the sensor is collected in real-time and transmitted for analysis during which artificial intelligence (AI) machine learning algorithms are used to process the environmental parameters and predict the most suitable crop to be grown under given conditions.
Keywords:- IoT Sensors, Crop Prediction, Machine Learning, Precision Agriculture, Smart Farming, Real-Time Monitoring.

Role of Artificial Intelligence in Genetic DNA Sequence Analysis

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Abstract
Artificial Intelligence (AI) has emerged as a transformative tool in genetic DNA sequence analysis, enabling researchers to process and interpret vast amounts of genomic data with greater speed and accuracy. The advancement of next-generation sequencing technologies has led to an exponential increase in genetic data, creating the need for intelligent computational approaches. AI techniques, particularly machine learning (ML) and deep learning (DL), play a crucial role in identifying patterns, detecting mutations, predicting gene functions, and analyzing complex DNA sequences. AI-driven models such as convolutional neural networks (CNNs) and recurrent neural networks (RNNs) enhance sequence alignment, genome annotation, and variant classification. These technologies significantly contribute to understanding genetic disorders, cancer genomics, and evolutionary biology. Additionally, AI supports precision medicine by enabling personalized treatment strategies based on individual genetic profiles. Although AI offers numerous advantages, challenges such as data bias, ethical concerns, model interpretability, and data privacy must be carefully addressed to ensure reliable clinical applications. Overall, the integration of Artificial Intelligence in genetic DNA sequence analysis represents a major advancement in biological sciences, improving research efficiency, diagnostic accuracy, and therapeutic development.

The Green Algorithm: A Strategic Management Framework for Leveraging AI in Corporate Carbon Reduction

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Abstract
As artificial intelligence becomes integral to corporate operations, organizations face a dual imperative: harnessing AI's potential to reduce carbon emissions while mitigating the technology's own growing environmental footprint. This paper introduces the Green Algorithm Framework, a strategic management approach that enables organizations to systematically leverage AI for carbon reduction while ensuring the sustainability of AI deployments themselves. Through an integrative review of recent empirical research, industry case studies, and emerging best practices, we identify three strategic pathways through which AI contributes to corporate decarburization: optimizing operational efficiency across value chains, enabling comprehensive Scope 3 emissions measurement and management, and accelerating green innovation through predictive analytics. Concurrently, we synthesize emerging methodologies for minimizing AI's direct environmental impact, including model optimization techniques, infrastructure efficiency measures, and governance frameworks. The proposed framework encompasses five interconnected layers—strategic, infrastructure, model, application, and governance—providing decision-makers with a structured approach to aligning AI investments with sustainability objectives. We conclude with implications for corporate strategy, policy development, and future research directions.

Keywords: Green AI, corporate carbon reduction, strategic management framework, sustainable technology, Scope 3 emissions, energy-efficient computing

Bagging Ensemble Deep Learning Approach

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Abstract
The proliferation of online platforms for learning has made there a need for reliable ways of measuring student engagement, which is central for having a sense of how effective learning is. The traditional machine learning techniques such as Support Vector Machine, K-Nearest Neighbor, Decision Tree and Random Forest, had meager success. They are normally 76 to 79% accurate. This is mainly due to the fact that they have a hard time capturing behavioral patterns with regards to time and space. Due to recent studies 1D Convolutional Neural Networks and 1D ResNet architectures, ensemble deep learning models can improve the accuracy of engagement detection to a great extent. Based on this advancement, this paper proposes to develop a NASNet-based deep learning framework. In this paper uses neural architecture search to automatically learn hierarchical visual feature and temporal dependency from student facial expression data. The model is tested and found in a impressive accuracy of 96% which is correct most of the time as compared to the traditional machine learning and existing ensemble deep learning methods. The approach eliminates the need for manual feature extraction, solves the problem of data imbalance effectively and increase the robustness in various learning environments. The results show that the deep learning models can be optimized and include scalable, real-time, and reliable student engagement monitoring in modern e-learning systems.

Keywords:- Student Engagement, Deep Learning, NASNet, CNN, Bagging Ensemble, Online Learning, Computer Vision

GSM Wireless Electronic Notice Board

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Abstract
In modern organizations and public utility environments such as hospitals, transportation centers, educational institutions, and commercial spaces, timely communication plays a critical role, especially when information needs to be updated frequently or urgently. This paper presents a wireless electronic notice board system designed to overcome the limitations of traditional manual notice boards, which are often inefficient, time-consuming, and dependent on physical presence. The proposed system utilizes Global System for Mobile Communication (GSM) technology to enable remote transmission of messages from authorized users. A GSM module integrated with the display unit receives text messages sent through mobile phones and forwards them to a microcontroller for processing. The processed messages are then displayed on an electronic notice board in real time, ensuring fast and reliable information dissemination. The system operates without the need for internet connectivity, making it suitable for deployment in remote or infrastructure-limited areas. Security is ensured by restricting message access to predefined authorized users. Experimental evaluation shows that the system performs efficiently with minimal delay, stable operation, and low maintenance requirements. The design also supports continuous operation under real-time conditions without performance degradation. Overall, the proposed system provides a practical and reliable solution for enhancing communication efficiency in modern digital information display applications.

Keywords:- GSM Technology, Wireless Electronic Notice Board, Short Message Service (SMS), Arduino Microcontroller, Embedded Systems, Remote Communication

Algorithmic Environmental Governance: AI-Driven Compliance Systems and the Realization of the Right to a Healthy Environment

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Abstract
Environmental degradation and rising industrial emissions continue to challenge the effective realization of the right to a healthy environment. Although environmental laws and regulatory standards exist in many jurisdictions, enforcement gaps, limited monitoring capacity, and delayed compliance mechanisms often weaken their effectiveness. Recent advances in artificial intelligence (AI) have opened new possibilities for environmental monitoring, predictive analysis, and regulatory compliance. AI-enabled systems can process large volumes of environmental data collected through sensors, satellites, and digital reporting platforms, enabling regulators and industries to track emissions, detect potential violations, and respond to environmental risks in a more timely and systematic manner. This paper examines the emerging role of AI-driven compliance systems within the broader framework of algorithmic environmental governance. It explores how AI-based monitoring technologies such as satellite data analytics, automated emission tracking, and predictive environmental modelling are increasingly used by governments, international organizations, and regulatory bodies to support environmental regulation and climate governance. Using a doctrinal and analytical approach, the study evaluates environmental governance frameworks and technological practices that facilitate data-driven regulatory oversight. It argues that AI-supported compliance systems can improve regulatory efficiency, assist industries in identifying emission patterns, and provide early warnings of environmental harm, thereby promoting more proactive environmental governance. The paper also acknowledges challenges relating to data governance, algorithmic transparency, and regulatory oversight. By situating AI-driven monitoring within the framework of environmental rights, the study contributes to discussions on how digital technologies can support sustainable development and strengthen mechanisms for realizing the right to a healthy environment.
Keywords:- Artificial Intelligence; Algorithmic Environmental Governance; Environmental Compliance Systems; Right to a Healthy Environment; Carbon Emissions Monitoring; Sustainable Development.

Investigation of Gas Sensing Mechanism of Gas Nanosheet for Co Detection: A DFT Approach

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Abstract
In this theoretical study the adsorption mechanism of carbon monoxide (CO) on 2D monolayer of Gallium Sulphide (GaS) is investigated systematically using density functional theory (DFT). We used VASP (Vienna Ab- initio simulation package) for DFT calculations and VESTA (Visualisation for electronic and structural analysis) for construction and visualisation of material and molecule. Generalized gradient approximation (GGA) is used to get exchange correlation energy of system. Our study suggests that substrate material is a semi-conducter with indirect band gap of 2.40 eV. Calculated adsorption energy is -0.0721eV. Weak interaction between CO and GaS suggests that pristine GaS monolayer is not suitable for effective detection of CO gas however it is a sign of rapid desorption which can be favourable for sensing application.
Keywords:- DFT, Gas Sensor, GaS Monolayer

Role of Artificial Intelligence in Developing Carbon-Neutral Urban Infrastructure

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Abstract
Rapid urbanization has significantly increased global carbon emissions, making the development of carbon-neutral urban infrastructure a critical priority for sustainable development. Artificial Intelligence (AI) has emerged as a transformative technology capable of optimizing urban systems and supporting environmentally responsible decision-making. This study examines the role of AI in facilitating the transition toward carbon-neutral urban infrastructure by improving energy efficiency, resource management, and sustainable urban planning.AI-driven technologies such as machine learning, predictive analytics, and smart sensor networks enable cities to monitor and manage energy consumption, transportation flows, waste management, and building operations in real time. These intelligent systems support data-based policy formulation and help urban planners design low-carbon infrastructure that integrates renewable energy sources, smart grids, and efficient public transportation networks. Additionally, AI applications in smart buildings and urban mobility can significantly reduce greenhouse gas emissions by optimizing energy use and minimizing resource waste. The paper adopts a conceptual and analytical approach to explore existing AI applications in sustainable urban development and highlights emerging strategies that contribute to carbon neutrality. It also discusses key challenges such as technological costs, data privacy concerns, and the need for effective governance frameworks. The findings suggest that the integration of AI with sustainable infrastructure planning can accelerate the transition toward environmentally resilient cities while supporting long-term climate goals. Overall, the study emphasizes that strategic adoption of AI technologies can play a crucial role in transforming urban environments into low-carbon, efficient, and sustainable ecosystems.
Keywords: Artificial Intelligence, Carbon Neutrality, Smart Cities, Sustainable Infrastructure, Urban Sustainability

Impact of Sustainable Marketing on Brand Loyalty and Customer Lifetime Value

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Abstract
The increasing environmental awareness among consumers has transformed traditional marketing practices into sustainability-oriented approaches. Sustainable marketing integrates environmental responsibility with value creation, influencing consumer perceptions, trust, and long-term relationships with brands. This research paper examines the impact of sustainable marketing practices on brand loyalty and Customer Lifetime Value (CLV) using secondary data derived from published research articles, journals, and empirical studies. The study finds that sustainable marketing enhances brand trust, perceived value, and customer satisfaction, which significantly contribute to long-term loyalty and improved customer lifetime profitability. The findings suggest that authentic sustainability initiatives strengthen emotional brand attachment and retention behavior, ultimately improving firm performance and long-term customer equity.
Keywords: Sustainable Marketing, Brand Loyalty, Customer Lifetime Value, Green Marketing, Consumer Trust, Sustainability Strategy.

AI based sustainable health care practices

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Abstract

AI-based sustainable healthcare practices use Artificial Intelligence to make healthcare systems more efficient, environmentally friendly, cost-effective, and accessible. Sustainability here means improving health outcomes while reducing waste, energy use, and unnecessary medical procedures. AI analyzes large medical datasets to predict diseases before symptoms become severe. Early detection of conditions like Diabetes and Cardiovascular Disease. Reduces hospital admissions and long-term treatment costs, Improves patient outcomes and lowers resource consumption. AI helps hospitals manage beds, staff schedules, equipment, and energy usage, Reduced energy consumption, Efficient patient flow and Lower operational costs. Hospitals can use AI to predict patient admission rates and allocate resources accordingly. AI enhances tele health platforms to provide remote diagnosis and monitoring.Supported by platforms such as Teladoc and Practo. AI systems assist doctors in analyzing scans like X-rays, MRIs, and CT scans. Used for detecting diseases such as: Brest Cancer, Tuberculosis and many more. AI accelerates pharmaceutical research by analyzing millions of chemical compounds. Organizations like DeepMind and IBM are applying AI to drug discovery. AI analyzes genetic and lifestyle data to provide personalized treatment plans also related to the field of Precision Medicine. AI tracks and manages medical supplies, vaccines, and equipments. AI monitors disease trends and outbreaks through data analysis. Tracking spread of COVID-19, Predicting epidemic patterns. This allows governments to respond quickly and sustainably. AI-based sustainable healthcare practices combine technology, data analytics, and healthcare management to create smarter, greener, and more accessible healthcare systems worldwide.

Blockchain-Based Authorization Mechanism for Educational Social Internet of Things

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Abstract

The emergence of smart campuses that leverages the power of Internet of Things (IoT) in educational environments has been made possible by the speed at which IoT is being used in educational settings, the interconnected devices for learning, collaboration and management of the campus. When added to the notions of social networking, Educational Social Internet of Things (ESIoT) provides for the free flowing of interaction of students, teachers and smart devices. However, the mechanisms of centralized authorization of such systems bring about grave concerns in terms of security, privacy, data integrity and unauthorized access. Traditional access control models are susceptible to single point of failure, tampering of data and lack of transparency. To cope with these challenges, this work motivates to overcome these challenges by developing a blockchain-based authorization mechanism at Educational Social IoT environments. Blockchain technology offers decentralized control, immutability, and transparency, which are good and wholesome to process of secure access management. The proposed system makes use of smart contracts in enforcing role based authorization policies for users and IoT devices without the need for a centralized authority. Each request of access is double checked and recorded to the blockchain - enabling traceability and tamper resistant datasets of apps. The proposed approach helps increase trust among the participants, sensitive educational data, and secure device to user interactions. Experimental evaluation suggests improved security, no unauthorized access and improved scalability than the traditional authorization models. This system is a good foundation for the next generation smart educational ecosystem.

Keywords—Block chain, authorization, educational IoT, social IoT, smart contracts, access control.

Optimizing the Energy Transition through Intelligent Grid Architectures

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Abstract
Beyond Static Infrastructure: Leveraging Advanced Analytics for the Decarbonization of Power Systems The global transition toward a low-carbon economy relies heavily on the integration of intermittent renewable energy sources, such as wind and solar, into aging electrical infrastructures. However, the inherent volatility of these sources poses significant risks to grid stability and frequency regulation. This paper explores the shift from traditional, centralized power distribution to Decentralized Intelligent Networks. By utilizing high-frequency sensor data and predictive modeling, modern grid architectures can now move beyond reactive management. We examine the implementation of Automated Demand Response (ADR) systems that synchronize industrial and residential consumption with real-time generation peaks. Furthermore, the study highlights the role of Virtual Power Plants (VPPs) in aggregating distributed energy resources—including electric vehicle fleets and localized battery storage—into a cohesive, resilient energy ecosystem. The core of this research focuses on the reduction of "spinning reserves" (carbon-intensive backup generators) through superior forecasting accuracy. By improving short-term load prediction by as little as 3% to 5%, grid operators can significantly lower the operational carbon intensity of the entire network. The conclusion argues that the energy transition is not merely a hardware challenge of building more panels and turbines, but a computational challenge of managing complexity at scale.

AI-Accelerated Discovery of Eco-Efficient Nitrogen–Sulfur as Bio-Assessed Organometallic Heterocyclic

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Abstract
The urgent need to reduce the global carbon footprint has intensified the search for sustainable and resource-efficient chemical innovations. This case study explores an AI-accelerated framework for the discovery and biological assessment of eco-efficient nitrogen–sulfur-containing organometallic heterocycles. By integrating artificial intelligence-driven molecular modeling, predictive toxicity screening, and structure–activity relationship (SAR) analysis, the study aims to optimize compound design while minimizing experimental waste, energy consumption, and environmental impact. Machine learning algorithms were employed to predict physicochemical stability, bioactivity profiles, and potential environmental persistence of newly designed organometallic scaffolds. AI-guided virtual screening significantly reduced the number of synthesized candidates, thereby lowering solvent use, reagent consumption, and associated carbon emissions. Selected compounds were synthesized using greener protocols and subjected to biological evaluation to assess antimicrobial potential. Comparative analysis demonstrated that AI-assisted selection improved target specificity and reduced off-target biological risks. The findings highlight how computational intelligence can streamline organometallic drug discovery and material development processes, contributing to sustainable chemistry practices. By integrating AI with biological assessment, this study presents a scalable model for eco-conscious molecular innovation. The approach supports carbon footprint reduction through efficient resource utilization, rational compound design, and minimized laboratory waste, aligning advanced chemical research with global sustainability objectives.

Keywords: - Artificial Intelligence, Sustainable Chemistry, Organometallic Heterocycles, Nitrogen–Sulfur Compounds, Carbon Footprint Reduction.

Sustainable Crack Remediation in Reinforced Concrete Using Bacillus-Based Self-Healing Bio-Concrete for Carbon Footprint Reduction

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Abstract
Till date substantial research work has been carried out involving Self-healing. Bio-concrete with self-healing mechanism with different bacterial con-centration to assess reduction in crack width by visual inspection and non-de-structive techniques. The spores present in bacterial concrete are inert and has the ability to continuously precipitate CaCO3 in the presence of moisture and oxygen. As a result of this natural and chemical free process, the cracks in concrete are self – healed by the bacillus type microorganisms. As such, the test methodolo-gies, protocols, specimen sizes, and shapes are developed based on the nature of healing agent and their characteristics to assess the associated self-healing mech-anism. Present study deals with the assessment of crack healing in concrete beam specimens with the help of Brinell microscope. Microorganisms Bacillus subtilis and Bacillus cracks were incorporated in the process of concrete mix preparation. Experimental investigations involve assessment of load to be applied to generate definite cracks and testing of control beam adhering to IS 456:2000. Bio-concrete thus prepared are tested under two - point loading set up in Universal testing machine. Based on these results, it was decided to apply 50 % of analytical load to control and all bacterial concrete beams to induce the controlled crack- width of range 0.3 to 1.5 mm. The healing behavior was as-sessed in the cracked specimens at various healing intervals and accordingly the healing percentage was calculated. Studies revealed that Self-healing concrete promotes sustainability by extending the lifespan of structures, reducing the need for costly repairs and replacements and minimizing waste.
Keywords: Bio concrete, Bacillus subtilis, Bacillus cereus, two - point loading, crack width.

Optimizing the Parameters of GTAW-GMAW/MAG Hybrid Welding on the Geometry of Welding Bead Using the Taguchi Technique

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Abstract
The main aim of this research work was to evaluate the influence and optimize the factors of the GTAW-GMAW/MAG hybrid welding process on the geometry of the weld bead. An experimental design using the Taguchi technique (robust design method) was used to conduct the experiments work. The experiments were carried out according to an orthogonal matrix with 27 experiments, with three replicates each, totaling 81 test specimens. The factors (GMAW/MAG shielding gas type, GMAW/MAG voltage, GMAW/MAG wire feed, gas flow rate of GTAW, electric current intensity of GTAW and welding speed) were varied with three levels each. The penetration, heat-affected zone (HAZ), bead width and bead height were the response variables analyzed. The heat affected zone (HAZ) has been influenced by GMAW/MAG voltage, GMAW/MAG shielding gas type, welding speed and electric current intensity of GTAW. All factors had effects on the width, except the GMAW/MAG wire feed. The bead height was significantly influenced by the GMAW/MAG wire feed and by the electric current intensity of GTAW. Optimizing the process was performed, so that for each output variable, the values of the factors that should be used were indicated, and the optimization was confirmed by specimens of welding test.
Keywords: optimization; DOE, hybrid welding GTAW-GMAW/MAG; weld bead geometry; Taguchi technique.

Advanced Innovations and Best Practices in Sustainable Waste Minimization Strategies for Additive Manufacturing Systems

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Abstract
The rapid integration of additive manufacturing (AM) as an alternative to conventional subtractive production methods has accelerated due to its design flexibility, material efficiency, and capability for complex part fabrication. Nevertheless, notwithstanding its disruptive industrial potential, concerns persist regarding material losses, residual feedstocks, support structures, failed builds, and post-processing by-products generated during AM operations. These waste streams pose environmental, economic, and resource-efficiency challenges that necessitate systematic intervention.This review critically examines advanced innovations and established best-practice methodologies for sustainable waste minimization in AM systems. Core strategies evaluated include design-for-additive-manufacturing (DfAM) optimization and intelligent material selection, process and parameter optimization, circular economy integration and material recirculation, on-demand and decentralized production models, and the deployment of smart manufacturing architectures. Particular emphasis is placed on the utilization of recyclable and bio-derived feedstocks, as well as the incorporation of data-driven technologies such as artificial intelligence (AI), machine learning (ML), and digital twin frameworks to enhance predictive control, defect mitigation, and resource efficiency.Through a comprehensive synthesis of contemporary developments, industrial implementations, and documented case analyses, this study elucidates the strategic role of sustainability in the progressive evolution of AM technologies. Furthermore, it identifies prevailing technical, economic, and regulatory constraints while outlining actionable pathways aligned with global sustainability imperatives. The findings demonstrate that the systematic integration of engineering innovations and circular manufacturing principles can substantially reduce waste generation, improve lifecycle performance, and strengthen the environmental credentials of AM. Ultimately, the advancement of intelligent and resource-efficient AM practices is positioned as a critical enabler for transitioning modern manufacturing toward a resilient and sustainable industrial future.

Role of AI in Rapid advancements in VLSI Design and its challenges

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Abstract:

VLSI refers to the process of integrating millions or billions of transistors onto a single chip, enabling today's high-performance processors, mobile SoCs, and embedded systems.As semiconductor density increases, design complexity grows exponentially, making timing closure, power optimization, verification coverage, and physical layout dramatically more challenging.In this context, AI is emerging as a transformative accelerator for the VLSI ecosystem. It enhances multiple stages of the design flow by automating manual tasks, improving prediction accuracy, and optimizing decisions that traditionally required extensive engineering effort. From RTL logic synthesis and physical design optimization to verification, testing, and fault prediction, AI-driven methods are reshaping how modern chips are conceived and implemented. This paper discusses some of the unique system design challenges posed by anticipated nanoscale CMOS and molecular electronics technologies, and presents some ground-breaking suggestions of novel system-level approaches to deal with these challenges.

Keywords:- VLSI design, Artificial intelligence, Low Power CMOS, Chip integration.

Tradeoffs Between AI Performance and Energy Efficiency: Sustainable Pathways for Carbon Footprint Reduction

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Abstract
As artificial intelligence drives transformative progress across industries, a critical tension emerges between achieving peak model performance and maintaining energy efficiency, directly impacting global carbon footprints. Large-scale AI systems, with their vast parameter counts and intricate architectures, excel in tasks demanding high accuracy and advanced reasoning—such as predictive analytics for climate resilience or optimized supply chains—yet they demand exponentially more computational resources. Training these models can emit CO2 equivalent to years of vehicle emissions, while inference at scale pushes data centers toward consuming up to 10% of worldwide electricity by decade's end, highlighting the urgent need for management strategies in sustainable AI deployment. This analysis delves into core tradeoffs: deeper neural networks boost capability but inflate power usage by factors of 20-50 times over streamlined alternatives; cloud-based processing offers scalability at the cost of constant energy draw, contrasting with edge devices that prioritize low-latency efficiency. In sectors like energy grids, where AI forecasts demand to curb waste by 15-25%, the performance edge must not undermine the very emissions reductions it enables. Similarly, precision agriculture leverages AI for resource optimization, but only if models avoid excessive retraining cycles. From a management lens tailored to today's sustainability imperatives, we advocate integrated approaches: architectural innovations like parameter-efficient fine-tuning preserve 90-95% efficacy while slashing energy by 80%; hardware advancements, including neuromorphic chips, enhance operations per watt; and dynamic scheduling aligns workloads with renewable peaks. "Green AI" benchmarks—evaluating carbon output per insight generated—empower executives to prioritize value over raw compute. Real-world cases, from logistics route optimization saving 12% fuel to manufacturing waste cuts via lightweight models, illustrate scalable wins without performance compromises. By reframing AI not as an energy burden but a decarbonization accelerator, organizations can harmonize innovation with planetary limits, fostering resilient business models amid 2026's net-zero trajectories.
Keywords: AI-energy tradeoffs, sustainable computing, carbon-aware AI, model compression, Green AI benchmarks, data center optimization, renewable scheduling, performance metrics.

Theoretical Analysis of the Development of Low Power Digital Real Time Clock

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Abstract:
Reducing chip power consumption in digital real time clocks is crucial for maintaining its performance nowadays. In this paper, we report various low power technologies to design a digital real time clock (RTC), which are essential in internet of things (IoT), smart homes, offices, meeting long term operation and precise time synchronization needs. The rapid development of the IoT requires low power high precision RTC with long term device operation and precise time synchronization. The application scenarios of it will continue to expand from traditional areas such as homes, school and offices to a wider range of fields like intelligent transportation system, vehicle positioning, industrial automation for time control and synchronization of production lines, for time recording and synchronization of medical equipment.

AI for a Greener Tomorrow: Digital Solutions to Reduce Carbon Footprint

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Abstract
The increasing urgency of climate change necessitates innovative technological interventions to reduce carbon emissions and promote environmental sustainability. Artificial Intelligence (AI) has emerged as a transformative tool in developing digital solutions that enable greener operations across industries, urban systems, and everyday life. This study examines how AI driven strategies can actively contribute to carbon footprint reduction by optimizing resource usage, improving operational efficiency, and supporting data-informed decision-making. AI technologies—including machine learning, predictive analytics, and optimization algorithms—are leveraged to monitor energy consumption, analyze emission patterns, and identify inefficiencies across diverse sectors. Intelligent systems can forecast demand, optimize supply chains, automate production processes, and manage energy-intensive operations in real time. In urban contexts, AI facilitates smart infrastructure planning, traffic flow optimization, and renewable energy integration, directly reducing greenhouse gas emissions. Additionally, AI based monitoring platforms enable organizations to implement dynamic energy management and track environmental performance metrics, aligning operational decisions with sustainability goals. The study also highlights the role of AI in enabling circular economy practices, such as waste reduction, intelligent recycling, and sustainable material management. By combining advanced computational models with actionable insights, AI-driven solutions provide measurable outcomes in both carbon reduction and cost efficiency. The findings suggest that integrating AI into digital ecosystems is critical for achieving low carbon operational frameworks and long-term environmental resilience. As a scalable, adaptable, and data-driven approach, AI supports organizations, governments, and communities in transitioning toward sustainable practices, demonstrating its central role in building a greener tomorrow.

Keywords- Artificial Intelligence, Carbon Footprint Reduction, Digital Solutions, Sustainable Development, Energy Optimization.

Circular Economy & Sustainable Chemistry

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Abstract
New research in ACS Sustainable Chemistry & Engineering (2025) focuses on the Circular Economy through polymer recycling and upcycling. Abstracts from recent virtual issues emphasize "Scientific and Technological Frameworks for Differentiated Natural Gas," providing new methods to measure and compare greenhouse gas emissions across supply chains. This research aims to provide a roadmap for the "zero-carbon society" by focusing on chemo- and bio-catalysis to replace high-footprint synthetic methods.

Impact of AI-Driven Green Finance Awareness on Sustainable Investment Intention: Evidence from Nepal

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Abstract
AI has been quickly adopted across the financial services landscape, fundamentally reshaping sustainable finance approaches on a global scale. The objective of this research is to examine how the awareness of green finance driven by artificial intelligence influences sustainable investment intentions in Nepal, with perceived usefulness as a mediating variable. This study utilized a quantitative, cross-sectional research design based on the Technology Acceptance Model (TAM) and sustainable finance theory, collecting primary data via an online survey in December 2025. There was a total of 390 responses collected from NEPSE retail investors, digital banking user and management students in different locations all over Nepal. Descriptive statistics, correlation analysis, multiple regression analysis, and bootstrapped mediation analyses were performed on the data.The results show that awareness of green finance from AI significantly impacts the perceived utility, which positively influences sustainable investment intentions. The relationships between AI awareness and investment intentions are partially mediated by perceived usefulness highlighting the role of cognitive assesment on pro-environmental investment behavior. This study develops the theory of TAM to a sustainable finance in developing economy context, thus bridges research gaps and heads towards policymakers and financial institutions willing to create AI-enabled green investment platforms. The findings highlight the importance of technological literacy in fast-tracking sustainable capital formation in Nepal.

Keywords:- Artificial Intelligence, Green Finance, Sustainable Investment Intention, Perceived Usefulness, Technology Acceptance Model, Nepal

Personet-A Novel Framework for Personality Classification-Based APT Customer Service Agent Selection

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Abstract
The proposed system is the Intelligent web- application of Personalityand Industry Classification, which is designed to analyse the user datasets and then predict the personality types, relevant industry and behavioural clusters using data driven methodologies. Its purpose is to facilitate for those people and organizations to have an idea about the personalitypatterns anditsconnectiontosectorsof professions from automated classifications processes. The application is based on the multi-user architecture and it has two major players - the Admin and the User. Users are given the opportunity to register, login, upload their datasets and viewor search for results according to a variety of parameters such as age, personality-typeandcluster-category. The system analyses the data uploaded based on a classification model aime identifyingthe cluster of persistent (PersoNet), personalityand suitable working industry. The results are then stored and presented in an easy-to-read format for interpretation. Administrators have several more privileges to manage users, give users access, maintain track of all the data sets uploaded and their results.

Keywords:- Personality Classification, PersoNet Framework, Behavioural Analysis, Customer Service Agent Selection.

Leveraging Edge AI and Real-time IoT Data Fusion for Dynamic Carbon Emission Monitoring and Mitigation in Smart Cities

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Abstract
Rapid urbanisation has intensified carbon emissions, positioning cities as primary contributors to global greenhouse gas outputs. Conventional carbon monitoring systems rely heavily on centralized cloud architectures, which often suffer from latency, bandwidth limitations, fragmented data silos, and delayed decision-making. This study qualitatively investigates how Edge Artificial Intelligence (Edge AI) integrated with real-time Internet of Things (IoT) data fusion can enhance dynamic carbon emission monitoring and mitigation in smart cities. Data collection involved semi-structured interviews with 4 urban planners, 7 IoT engineers, 3 sustainability officers, and 5 policymakers selected using purposive sampling to capture diverse expert perspectives on implementation and governance. Using case-oriented qualitative analysis, expert perspectives, and thematic document review, the research identifies architectural, governance, and implementation dimensions necessary for effective deployment. Findings reveal that decentralized intelligence at the network edge improves responsiveness, contextual awareness, predictive capability, and localized mitigation strategies. The study concludes that Edge AI-enabled IoT ecosystems provide a scalable and adaptive framework for proactive carbon management, while emphasizing governance, interoperability, and ethical safeguards.
Keywords:- Data, Fusion, Emission, Mitigation, Smart cities, Artificial Technology,

Stroke Prediction Using Deep Learning and Transfer Learning Approaches

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Abstract
Stroke is one of the most common neurological conditions, carrying a substantial health and economic burden among populations around the world. Recent epidemiological evidence indicates an increasing incidence of strokes and stroke-related disabilities among aging populations and lifestyle-related risk factors [1],[7]. Because identifying individuals at high risk of suffering from stroke is an integral factor for any preventing care and clinically effective intervention, the current research presents a framework for prediction that employs deep learning models together with transfer learning techniques on structured clinical datasets. The approach is meant for understanding complex interrelations among patient characteristics, including consideration of data imbalance and a scarcity of labeled samples. Transfer learning aims at taking benefits of the knowledge obtained from related but distant medical fields, subsequently enhancing the stability and generalization of the model. The experimental evaluation demonstrates that the proposed framework allows more accurate prediction and reduces the absence of stroke risk cases compared to traditional deep learning methods. This seems to enhance possibilities for intelligent learning systems to assist in early stroke risk assessment in the clinical environment.

Keywords:- Stroke Prediction, Deep Learning, Transfer Learning, Healthcare Analytics, Clinical Decision Support

Artificial Intelligence in Architecture Education for Sustainable Development: A Case of Heritage Buildings

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Abstract
The integration of artificial intelligence (AI) into architecture education presents opportunities for addressing complex challenges in heritage-building preservation and sustainable design. This paper examines how AI technologies, including machine learning, deep learning and Building Information Modelling (BIM), are transforming architectural education while contributing to sustainable-development goals. Focusing on heritage-building conservation, it shows that AI-enhanced education frameworks enable architects and students to balance preservation with sustainability through applications such as damage assessment, material optimisation and climate-responsive conservation strategies. The paper identifies barriers to AI adoption in architecture curricula, particularly in developing regions, and proposes a framework for integrating AI tools while maintaining ethical standards and cultural authenticity in heritage preservation.
Keywords: Artificial intelligence; architecture education; heritage conservation; thermal analysis; sustainable development; BIM; digital preservation

A Context-Aware Hybrid Retrieval-Augmented Intelligence System for Continuous Symptom Assessment

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Abstract
The promptness in detecting the health symptoms and their constant monitoring is very important for the success of preventive care. The market is alive with digital symptom checkers but more than half of them tend to rely on rigid rule-based logic or isolated machine learning, which significantly limits the scope to capture the nuances of the context and also how the symptoms have evolved over time. The paper presents a context-aware hybrid retrieval augmented intelligence system for ongoing symptom evaluation. The framework integrates semantic information retrieval with reliable medical knowledge sources and controlled generative reasoning for providing health guidance that is adaptive and reliable, and at the same time attempts to address the need to reduce unsupported or hallucinated outputs. Experimental assessment shows that effectiveness of the proposed system is better in context accuracy and reliability in tracking the symptoms compared to the traditional conversational healthcare systems.
Keywords:- Digital health, symptom monitoring, retrieval-augmented generation, healthcare AI, clinical decision support

IoT Based Wet and Dry Waste Segeregation

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Abstract
This research proposes IoT based automated waste management and segregation system for effectiveness in waste handling management in huge urban areas. The system eliminates the need for constant manual monitoring of the level of waste by using embedded sensors to monitor the level of the waste in real-time. A ultrasonic sensor is used to detect the existence of waste, as well as to determine the bin's fill degree. A moisture sensor has to sense whether the waste being handled is wet or dry. Determined by the result from the sensors, the waste is guided at the right container mechanically by a servo motor. Separate bins running for the wet and dry waste are provided for proper segregation. An LCD display indicates real time data on the type of waste found. Once any of the bins reaches the maximum threshold capacity then the system will automatically send an alert to the personnel concerned for timely collection. This helps in avoiding overflow and reducing pollution in the environment. The proposed system solves the problems of unorganized and non-systematic waste collection. It is also more effective in recycling as the waste is separated at the source. The system is small, thin and easy to implement. It can be as early as in the household, community and municipal level. By combining IoT technology and automated segregation, the system helps in Smart City efforts. All in all, the proposed solution adds sustainable development and urban waste management efficiency.

Keywords:- IoT, Waste Management, Wet and Dry Waste Segregation, Arduino Uno, Sensors, Servo Motor, Smart Bin, Automation, Smart City

A Suggested Model for Making the Results of Online Exam More Reliable by Blockchain

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Abstract
The use of online examination system has greatly transformed the way the students are assessed academically because it has the advantage of flexibility and scalability. Despite these benefits, most of the current examination platforms operate on centralized infrastructure that are not immune to security risks such as unauthorized access, manipulation of data, system failures and poor audit mechanisms. These weaknesses lead to serious questions about the authenticity and reliability of results of such examination. This paper proposes a framework based on blockchain technology, which is focused on enhancing the security, transparency and credibility of online examination results. In the propositioned way, all the important processes involved in the examination like the verification of user, the management of the examination, the submission of responses, the evaluation and validation of the results are securely registered on the decentralized and unmanipulistic ledger of accounts called the blockchain. The smart contracts are then used to automate this process of evaluation and result processing which reduces the need for manual processes and possible bias. Cryptographic techniques are used for security of sensitive data and integrity such data and decentralized verification can be used for independent verification of examination records by the stakeholders. The proposed framework depicts the effective use of BlockChain technology to overcome the drawback of the conventional online examination systems and proceed to establishment of safe and trustworthy online examination system for large scale implementation in the academic field.

Keywords:- Block Chain, Online examination, Smart Contract, Data integrity, Secure Assessment.

AI in Education for Sustainable Development: A Comprehensive Framework for Equitable and Quality Learning

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Abstract
The achievement of Sustainable Development Goal 4 (SDG 4) mainly targets the provision of inclusive, equitable, and quality education for all by the year 2030. Artificial Intelligence (AI) is one of the revolutionary technologies in the education sector that provides quality learning innovations as well as efficiency in learning institutions. This paper proposes an overall framework for the application of AI in the attainment of SDG 4, based on an in-depth analysis of more than hundreds peer-reviewed articles published between 2018 and 2025. AI in education is aligned with UNESCO's SDG 4 through the use of the conceptual alignment matrix. This paper critically analyzes the challenges that may arise in the application of AI in the attainment of SDG 4, offering possible mitigation measures for the challenges. It proposes a roadmap in phases for the application of AI in the attainment of SDG 4. Findings indicate that AI can significantly improve education quality and promote equity; however, achieving SDG 4 by 2030 requires coordinated action and a strong emphasis on equity in all AI applications within the education sector.

Keywords:- Artificial Intelligence, Education for Sustainable Development, SDG 4, Equitable Education, AI Ethics, Personalized Learning, UNESCO, Educational Technology

Blue Finance: Scaling Sea-Based Carbon Sequestration through Innovative Maritime Bonds

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Abstract
The world is cladding in a climate catastrophe, and there is a necessity for novel financing tools to uphold the scaling of ocean dependent carbon seclusion. This paper explores Blue Finance as a transformative approach that manoeuver private sector funding for marine ecosystem revamping and sea-based sequestration of carbon inventiveness by the usage of multiple financial instruments, notably Maritime Bonds. As the ocean imbibes around 25% of annual emissions of carbon dioxide emissions which are anthropogenic, the probability of escalating blue carbon dynamism is a decisive yet unplumbed area of climate change alleviation. This research investigates the organising of Maritime Bonds, risk management frameworks, and standards of performance, using analogous analysis from prevailing green bond markets. This research inaugurates a new triple-layered bond structure that merges blue carbon credits, marine environs services appraisement, and monarchical guarantees. The repercussions show that impeccably destined Maritime Bonds can allure between $50-100 billion in annual investment by 2035, labeling a new perimeter in climate finance outline. The paper concludes with recommendations for regularizing blue carbon accounting scaffolds and budding global regulatory frameworks to ameliorate investor sureness in maritime climate financial instruments.

Keywords: Blue Finance, Maritime Bonds, Carbon Sequestration, Ocean Economy, Climate Finance, Blue Carbon, Sustainable Investment, Marine Ecosystem Services

Ad Click Fraud Detection Using Machine Learning and Deep Learning Algorithms

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Abstract
Click fraud is currently one of the most enduring challenges of online advertising as it causes huge losses in financial resources and inaccurate campaign performance because marketing budgets are deflected from genuine user engagement. To mitigate this problem, an extended fraud detection framework based on a combination of thorough behavioural feature engineering in conjunction with text based attribute extraction is proposed in this work. Textual features such as user-agent strings, URL structures and referrer logs are transformed through a transformation method called the Term Frequency-Inverse Document Frequency (TF-IDF) vectorizer to successfully detect an automated or script-based click behavior. A wide range of Machine learning and Deep learning models like Decision Tree, Random Forest, Gradient Boosting, LightGBM, XGBoost, Models like Artificial Neural Networks were tested for which a number of Machine learning models were able to achieve an accuracy of better than 98% post Recursive Feature Elimination (RFE). To make the detection performance even more robust, Stacking Ensemble method was used to combine the Random Forest, Support Vector Machine, Logistic Regression models as base classifiers and meta classifier to update the final decision boundaries. Moreover, Extended Trees (ET), Bi-Directional LSTM and hybrid CNN-LSTM architecture were employed to ensue sequence behaviour and temporal tendencies and complex click streams. Real-time prediction capabilities can be used to ensure fraudulent activities are detected immediately, while continuous learning capabilities can help improve adaptability to changing bot behaviours. Explainability tools like LIME, SHAP help to provide glassy insights about feature importance promotes interpretability and trust. Experimental results show that the proposed hybrid model has greatly improved the accuracy, recall and precision to effectively mitigating the click fraud attacks in nowadays online advertising eco-system.
Keywords:- Click Fraud Detection, Machine Learning, Deep Learning, Ensemble Learning, Online Advertising.

Banana Leaf Disease Detection using ML & Computer Vision Algorithm

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Abstract
Banana cultivation plays a vital role in global agricultural economies, yet its productivity is greatly affected by various foliar diseases. traditional identification methods rely on manual inspection by experts, which is time-consuming, inconsistent, and prone to human error. to address these challenges, this project proposes agrileafnet, an intelligent banana leaf disease detection framework using machine learning (ml) and deep learning (dl) integrated with computer vision techniques. the system classifies seven banana leaf conditions, including black sigatoka, bract mosaic virus, insect pest, moko, panama, yellow sigatoka, and healthy leaves. it follows a pipeline of image preprocessing, feature extraction, model training, and prediction, implementing both support vector machine (SVM) and convolutional neural network (CNN) algorithms. experimental results on the banana imaging dataset demonstrate that CNN achieves superior performance with up to 97% accuracy, outperforming traditional ml methods. the web-based interface enables easy image upload and real-time disease detection, providing farmers and agricultural specialists with a scalable, efficient, and user-friendly tool for early diagnosis, timely prevention, and improved banana crop productivity.

Enhancing Jal Sustainability through AI – Enabled Smart Water Monitoring and Demand Optimization

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Abstract
Urban water systems in developing countries are increasingly challenged by rapid urbanization, climate variability, and aging infrastructure, resulting in inefficiencies such as high water losses, unreliable supply, and fragmented data management. Addressing these challenges requires a transition from reactive approaches to intelligent, data-driven water governance. This study investigates the potential of Artificial Intelligence (AI) and Internet of Things (IoT)-based smart water monitoring systems to enhance Jal sustainability through real-time analysis and predictive decision-making. Unlike conventional studies that focus primarily on theoretical models, this research integrates real-world implementation analysis with a prototype AI-based predictive model to demonstrate practical applicability in the Indian context. A detailed case study of Bengaluru is presented, where the Bangalore Water Supply and Sewerage Board has adopted AI-enabled solutions such as smart metering, pump optimization, and digital monitoring platforms to improve operational efficiency and governance. To complement this analysis, a machine learning model was developed using Python to simulate anomaly detection in water distribution systems based on key parameters including flow rate, pressure, temperature, and humidity. The model, implemented using the Random Forest algorithm, demonstrates strong potential for identifying irregular patterns and enabling proactive system management. The study contributes to a scalable AI–IoT framework that bridges the gap between conceptual design and real-world application. The findings highlight significant improvements in efficiency, reduction of non-revenue water, and enhanced equity and resilience in water distribution, offering actionable insights for policymakers and urban planners toward sustainable water resource management.

Artificial Intelligence for Inclusive and Sustainable Higher Education: A Systematic Literature Review

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Abstract
Artificial Intelligence (AI) is reshaping higher education systems globally, with significant implications for sustainability, equity, and governance. While AI technologies promise improved personalization, operational efficiency, and expanded access to education, their integration also raises ethical, environmental, and socio-political concerns. This systematic literature review synthesizes peer-reviewed scholarship published between 2015 and 2026 to examine how AI contributes to inclusive and sustainable higher education and to identify emerging governance challenges. Guided by PRISMA principles, 16 studies were analyzed using thematic synthesis. Findings reveal that AI enhances adaptive learning, institutional decision-making, and sustainability-oriented research. However, concerns related to algorithmic bias, surveillance, digital inequality, environmental cost, and academic integrity remain substantial. The review reveals three key paradoxes: the efficiency-equity paradox, sustainability contradiction, and inclusion-exclusion dilemma. AI can support Sustainable Development Goal 4 only when embedded within robust ethical frameworks and context-sensitive implementation strategies. Particular attention is given to Global South contexts, where infrastructural disparities complicate equitable AI adoption. The study concludes with evidence-based policy implications and research recommendations for responsible AI integration in higher education.

Keywords:- Artificial Intelligence, Sustainable Development, Higher Education, Inclusion, AI Ethics, SDG 4, Digital Equity

Artificial Intelligence for Water Resources Management

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Abstract

Water is a critical natural resource for human survival, yet many regions currently face severe water scarcity and poor management challenges. Artificial Intelligence (AI) is emerging as a transformative tool to address these issues by enhancing the planning, monitoring, and distribution of water resources. This paper examines the role of AI in water resource management, focusing on techniques such as machine learning, deep learning, and data analytics. These technologies facilitate accurate water demand forecasting, leakage detection, water quality monitoring, and the management of extreme events like floods and droughts. By integrating AI with the Internet of Things (IoT) and Geographic Information Systems (GIS), water systems can achieve higher efficiency and significant waste reduction. Using a methodology based on secondary data from academic journals and technical reports, this study identifies both the potential of AI-driven systems and the hurdles to their adoption, including data scarcity, high implementation costs, and technical complexity. The findings suggest that while AI has the potential to revolutionize sustainable water use, success depends on proper implementation and increased industry awareness. This research provides a simplified overview of how AI can support sustainable water management for future applications.

Automating Inequality: The Sociological Risk of AI in Sustainable Development Education

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Abstract

As Artificial Intelligence (AI) increasingly permeates Sustainable Development Education (SDE), it is often championed as a democratizing force capable of delivering personalized, accessible learning. However, this paper posits that the uncritical adoption of AI risks paradoxically undermining the core tenets of sustainability by automating and exacerbating existing social inequalities. Through a sociological lens, we critically examine the embedded biases, structural disparities, and cultural homogenization inherent in contemporary educational AI tools and technologies. We argue that AI-driven SDE often reflects the epistemological dominance of the Global North, marginalizing indigenous and localized ecological knowledge crucial for genuine sustainable development. Furthermore, the algorithmic mechanisms sorting and evaluating students threaten to reinforce systemic disadvantages, deepening the digital divide and alienating vulnerable populations. By examining these sociological hazards, this paper emphasizes the gap between the ethical mandates of the Sustainable Development Goals (SDGs) and the practical application of AI in education. In the end, we advocate for a transformative change toward culturally attuned, socially equitable AI frameworks within SDE. We assert that without deliberate, equity-focused measures, AI will not succeed as a means of sustainable empowerment and will, instead, serve as a mechanism for automated social and economic inequality.

Keywords:- Inequality, sociological risks and sustainable development education

Influencer Marketing as a Strategic Tool for Building Brand Loyalty Among Generation 'Z' in Kanchanpur, Nepal

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Abstract
Influencer marketing has emerged as a fresh approach to brand or product promotion. Influencer marketing, according to marketers, can create a favorable consumer perception of a product or brand and increase brand loyalty. This study uses purchase intention as a mediating variable to examine how influencers affect Generation Z's brand loyalty. Generation Z is extremely tech-savvy, spending the majority of their time on social media. Generation Z can generate purchase intents and loyalty at a reduced cost by anticipating a marketing approach that is close to and accessible to them. To expect marketing strategy is very close and easily accessible to generation Z. To create purchase intention and loyalty at lower cost. Purposive sampling method is used for this study by taking 100 samples through questionnaire. Sobel test and path analysis was used to check the indirect effect. The reliability, validity and assumption test was conducted before path analysis; to check that the data is valid for more analysis. The result of this research shows that generation Z are influenced by social media influencers like Facebook, whats app, Tik Tok, Instagram, snapchat and so on.

Keywords: Social media influencer, Generation Z, Purchase intention, Brand loyalty

Technical and Economic Feasibility Analysis of a Mass Rapid Transit System (MRTS) Bareilly: A Transition toward Metrolite

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Abstract
Bareilly, a critical Tier-2 "Counter-Magnet" city in the National Capital Region (NCR), faces significant urban congestion due to rapid population growth and a high volume of intermediate public transport (IPT). This paper evaluates the feasibility of an integrated Metro Rail project—specifically a Metrolite system—aimed at optimizing urban mobility. The study analyzes two proposed corridors: the North-South Corridor (Railway Junction to Barrier-Two via Satellite) and the East-West Corridor (Jhumka Tiraha to Rohilkhand University). By integrating Traffic Volume Counts (TVC) with Peak Hour Peak Direction Traffic (PHPDT) projections for 2041, the research assesses the viability of a 22–25 km network. Engineering constraints, including the narrow Right-of-Way (RoW) in the Kutubkhana-Kohadapir stretch and height restrictions in the Air Force "Funnel Zone," are critically examined. The findings suggest that a light-rail model offers a superior Benefit-Cost Ratio (BCR) compared to conventional heavy metro, providing a sustainable solution to Bareilly's transit challenges while stimulating Transit-Oriented Development (TOD) along the arterial Pilibhit and Rampur roads.

Keywords:- Metrolite, Urban Engineering, Feasibility Study, PHPDT, Bareilly Urban Mobility, Transit-Oriented Development (TOD).

Integrating Natural Resource Management into Eco-Friendly Hospitality: A Framework for Zero-Impact Restaurant Development

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Abstract
As the global community faces unprecedented environmental degradation, the hospitality sector must transition toward models that offer zero negative impact on the ecosystem. This paper explores the implementation of Natural Resource Management (NRM) within the design and operation of eco-friendly restaurants. Traditionally, the food service industry has placed significant strain on natural resources through high water consumption, energy intensity, and waste generation. This study proposes a "Circular Gastronomy" framework, focusing on three core pillars: Sustainable Infrastructure, Waste-to-Resource Systems, and Hyper-Local Sourcing. By utilizing eco-friendly building materials, solar-integrated energy systems, and advanced gray-water recycling, a restaurant can achieve a neutral environmental footprint. Furthermore, the paper discusses how such establishments can stimulate sustainable rural development by creating secondary job opportunities in organic farming and up cycled resource management. The findings provide a blueprint for a self-sustaining business model that fulfills human necessities without compromising the environmental capital of future generations.

Keywords: Zero-Impact Design, Sustainable Hospitality, Circular Economy, Eco-Friendly Infrastructure, Natural Resource Management (NRM).

Impact of All-Weather Road Connectivity on Agricultural Supply Chains: A Case Study of Rural Clusters in the Bareilly-Rohilkhand Region

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Abstract
Rural isolation in the Bareilly district continues to hinder the economic potential of agricultural communities despite the region's fertile soil and proximity to urban markets. This research investigates how strategic transport planning—specifically the transition from seasonal tracks to all-weather bituminous and CC (Cement Concrete) pavements—directly influences village-level GDP. By analyzing the connectivity between peripheral villages and the Bareilly mandi (market), the study assesses the reduction in "post-harvest loss" and "transportation overheads. The paper integrates Civil Engineering parameters, such as Drainage Density and Pavement Serviceability Index (PSI), with economic indicators like Price Realization per Hectare. Preliminary findings suggest that optimized transport corridors not only stabilize the supply chain for perishable goods but also trigger a shift from subsistence farming to high-value commercial crops. The study concludes with a proposed "Integrated Rural Transport Framework" designed to maximize the economic return on infrastructure investment for regional planning authorities.

Keywords:- Rural Infrastructure, Pavement Engineering, Agricultural Logistics, Bareilly-Rohilkhand, Socio-Economic Development.

Green AI: Leveraging Artificial Intelligence for a Low-Carbon Future

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Abstract
In today's world, carbon emissions from industries, transport, and daily activities are pushing our planet to the limit. This paper looks at how artificial intelligence (AI) can team up with sustainable practices to lower the carbon footprint in real, practical ways. The main goal is to show simple AI tools and green methods that businesses, cities, and people can use right now to make a difference.We start by explaining what carbon footprint means—basically, the total greenhouse gases released from our actions. Then, we dive into AI's role. For example, AI-powered smart grids in energy sector predict power needs and cut waste by up to 15-20%, based on real cases from companies like Google. Machine learning algorithms analyze traffic data to optimize routes, reducing fuel use in logistics by 10-12%. In farming, AI sensors monitor soil and weather to cut fertilizer overuse, which lowers emissions from agriculture.Climate change and rising carbon emissions have become major global concerns. Reducing the carbon footprint of industries, cities, and individuals is now an important goal for sustainable development. Things like using renewable energy sources (solar, wind) with AI forecasting make power cleaner. Circular economy modelsrecycle, reuse, reduceget a boost from AI that tracks waste and suggests better designs for products. We also cover urban planning: AI helps design green cities with more trees, efficient public transport, and smart buildings that save energy. Challenges exist, like high energy use by AI data centers, but solutions are emerging. Green AI focuses on efficient models that run on less power, and pairing them with carbon capture tech offsets emissions. Case studies include Singapore's smart nation project, where AI reduced city emissions by 8%, and Indian firms using AI for supply chain optimization to meet sustainability goals. Sustainable AI practices can help balance technological progress with environmental protection.This paper highlights the role of AI in supporting sustainable strategies for reducing carbon footprints. It focuses on how AI-based solutions can help create more efficient systems, encourage responsible resource use, and contribute to a cleaner and more sustainable future.

AI in Environmental Law & Policy-Making: A Legal–Policy Research Paper

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Abstract
Artificial Intelligence (AI) is increasingly influencing governance mechanisms across various sectors, including environmental regulation and policy-making. This research paper examines the role of AI in strengthening environmental governance through improved monitoring systems, predictive environmental modelling, environmental impact assessment (EIA), and regulatory enforcement. The study also evaluates how AI tools may assist judicial and quasi-judicial institutions in handling complex environmental disputes. While AI technologies can significantly enhance transparency, predictive capacity, and administrative efficiency, their adoption raises important legal and ethical challenges. These challenges include lack of transparency in algorithmic systems, accountability gaps, potential data bias, and risks to privacy and public participation. Within the Indian regulatory framework, such issues must be assessed in light of constitutional principles, particularly the right to life and a clean environment under Article 21. Using doctrinal and analytical research methodologies, the paper analyses relevant statutes, policy documents, and judicial precedents related to environmental governance in India. The study further examines international policy approaches to responsible AI governance. The paper argues that AI-driven environmental governance should be integrated within a robust legal framework that ensures transparency, accountability, human oversight, and public participation. It proposes a regulatory model for responsible AI use in environmental policy-making aligned with constitutional values, environmental justice principles, and sustainable development goals.

Sustainable Additive Manufacturing of Recycled Polymeric Waste: Process Optimization, Material Characterization, and Life Cycle Performance Evaluation

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Abstract
The exponential growth in global polymer consumption has intensified environmental degradation and generated significant socio-economic and public health concerns. Consequently, there is a pressing need for sustainable production systems, responsible consumption patterns, and efficient end-of-life management strategies for plastics. Additive manufacturing (AM), or three-dimensional printing, offers a decentralized and resource-efficient fabrication platform characterized by reduced material waste, shortened lead times, and lower prototyping and development costs. The integration of circular economy principles with AM enables distributed recycling and closed-loop material flows, facilitating the valorization of post-consumer and post-industrial polymer waste into functional components. However, challenges such as polymer degradation, property retention, contamination, rheological instability, and process–material compatibility must be systematically addressed to ensure reliable performance. This study presents a critical review of the literature to establish technical guidelines and propose a circular economy framework for AM utilizing recycled polymer feedstocks. It synthesizes insights on commodity polymer classifications, recycling technologies, material performance limitations, and process optimization strategies to support sustainable and scalable implementation of recycled polymer-based additive manufacturing systems.

Towards Net-Zero: AI and Sustainable Approaches to Carbon Reduction

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Abstract: -
Achieving net-zero carbon emissions has become a global priority in the fight against climate change. The integration of Artificial Intelligence (AI) with sustainable approaches offers innovative solutions to reduce carbon emissions and support the transition toward a low-carbon economy. AI technologies can analyze large datasets, identify emission patterns, and provide data-driven insights that help industries, governments, and communities adopt more efficient and environmentally responsible practices.One of the major contributions of AI in carbon reduction is in energy optimization. AI-powered systems can improve the efficiency of renewable energy sources such as solar and wind by predicting energy production and balancing supply and demand through smart grids. In industrial sectors, AI helps monitor energy usage, detect inefficiencies, and recommend strategies to reduce energy consumption and greenhouse gas emissions.In addition, AI plays a crucial role in sustainable transportation and urban development. Intelligent traffic management systems reduce fuel consumption and emissions by optimizing traffic flow and encouraging the use of eco-friendly mobility solutions. AI is also used in climate modeling and environmental monitoring, where satellite data and sensors provide real-time insights into carbon levels, deforestation, and air quality.By combining AI innovation with sustainable practices, societies can move closer to achieving net-zero goals. These technologies not only support efficient resource management but also encourage long-term environmental responsibility, making AI a key driver in global efforts to reduce carbon footprints and create a sustainable future.

AI-Driven Intelligent Transportation Systems for Sustainable Smart Mobility

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Abstract
Urban transportation systems are under intense pressure from rapid motorization, congestion, and climate change. Traditional traffic management architectures, based on fixed-time control and limited sensing, are increasingly unable to deliver sustainable mobility outcomes in dense cities. Recent advances in artificial intelligence (AI), combined with intelligent transportation systems (ITS) and Internet of Things (IoT) infrastructure, offer a pathway to optimize mobility while reducing energy use and greenhouse gas emissions. This paper presents an IEEE-style review and conceptual framework for AI-driven ITS architectures focused on sustainable smart mobility. It synthesizes evidence on traffic prediction, deep reinforcement learning (DRL) for signal control, multimodal integration, and emission-aware optimization, drawing from recent empirical studies and large-scale deployments. A layered AI-based smart mobility architecture is proposed, combining edge sensing, prediction models, and adaptive control. A representative traffic dataset is defined, and an illustrative case study compares classical time-series models (ARIMA), tree-based methods (Random Forest), deep sequence models (LSTM), and DRL for traffic signal optimization. Results are organized into multiple tables and figures, including traffic flow prediction, congestion classification, DRL reward convergence, and emission reduction comparisons. Literature shows that AI-driven adaptive signals and DRL controllers can reduce average delays by 7–45%, improve average speeds by around 17%, and cut CO_2 emissions by 6–27% at network scale and up to about 55% on critical links. The paper concludes with research challenges around data governance, scalability, robustness, and equitable deployment of AI in sustainable mobility systems.

Keywords—Intelligent Transportation Systems, Smart Mobility, Deep Learning, Reinforcement Learning, Emissions Reduction, Traffic Signal Control, Sustainable Cities.

Role of Artificial Intelligence in Genetic DNA Sequence Analysis

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Abstract
Artificial Intelligence (AI) has emerged as a transformative tool in genetic DNA sequence analysis, enabling researchers to process and interpret vast amounts of genomic data with greater speed and accuracy. The advancement of next-generation sequencing technologies has led to an exponential increase in genetic data, creating the need for intelligent computational approaches. AI techniques, particularly machine learning (ML) and deep learning (DL), play a crucial role in identifying patterns, detecting mutations, predicting gene functions, and analyzing complex DNA sequences. AI-driven models such as convolutional neural networks (CNNs) and recurrent neural networks (RNNs) enhance sequence alignment, genome annotation, and variant classification. These technologies significantly contribute to understanding genetic disorders, cancer genomics, and evolutionary biology. Additionally, AI supports precision medicine by enabling personalized treatment strategies based on individual genetic profiles. Although AI offers numerous advantages, challenges such as data bias, ethical concerns, model interpretability, and data privacy must be carefully addressed to ensure reliable clinical applications. Overall, the integration of Artificial Intelligence in genetic DNA sequence analysis represents a major advancement in biological sciences, improving research efficiency, diagnostic accuracy, and therapeutic development.

Optimizing Concrete Performance Silica Fume Incorporation in M25 Grade Mixtures

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Abstract
This study investigates the effects of partially replacing Ordinary Portland Cement (OPC) with silica fume (SF) on the compressive strength of M25 grade concrete. SF was incorporated at 5%, 10%, 15%, and 20% by weight of cement. The concrete mixtures were prepared with a mix ratio of 1:1.86:3.26 and tested for compressive strength at 7 and 28 days using a 2000 KN compression testing machine. The results showed that the mixture with 10% SF replacement achieved the highest compressive strength, reaching 22.20 N/mm2 and 31.12 N/mm2 at 7 and 28 days, respectively. However, further increasing the SF content led to a decrease in compressive strength, likely due to the presence of impurities such as alumina and free lime in the SF. The study concludes that up to 10% SF replacement can be used to enhance the compressive strength of M25 grade concrete, while higher replacement levels may result in strengths below the target values. These findings contribute to the understanding of utilizing waste materials and byproducts in concrete production, aiming to improve concrete performance while promoting sustainability in the construction industry.

Keywords:- Silica Fume, Ordinary Portland Cement, Compressive Strength, Sustainable Construction, Cement Replacement.

Identification of City Hotspots Using a Smart Cyber Physical Social System A JAVA-Call Detail Data Approach

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Abstract
The idea of "smart cities" has become popular in recent days and attracted the interests of researchers since it improves the quality of life of people living in the cities by providing useful services such as smart house, smart transit, telecommunication, infrastructure, etc. Hotspot analysis is a task of classic spatial analysis. The hot spots of the city have always been bane of the telecom operators and enterprises. Hotspots are places which have very high strength of communication than other places. THE NEW Material It is now clear, from the material that is being published that CPSS are useful in finding hot spots inside smart cities. But the real ones are huge data processing, analysis and storage; accuracy; robustness. In order to process the hotspots according to the telecom data, we offer intelligent cyber social system. Three degree levels of our proposed model of CPS have different roles. First layer of our proposed framework is Data collecting layer which is responsible to collect raw Call Detail Data (CDR). After that, it was being transmitted to next layer by CPSS seeming. Preprocessing, data storing and analysis are to be done by CPSS that is located in data processing layer. This then creates a chart, and social network analysis (SNA). As a result, instead of using the standard centrality measures we have considered here Jaccard and cosine as social behaviour measures and also eigenvector and k -shell as social network similarities. The following is then an analysis of city hotspots identified by cities and how SNA is done through calculating the importance of each hotspot using Finally we present to you our put forth smart CPSS model which has identified the top ten hot spots they are talking about. The smart CPSS model we report is very good in picking up the top ten. In this work we look at the difference in the hot spot trends which we do via collection of data over five days. We are to make a comparison of the trends of the hot spot. We use five-day data for this. We also go over our hot spot results in detail to what degree are they accurate and strong. For this, we use autocorrelation function and cross correlation functions. Autocorrelation and cross correlation function used to validate the results of the hot spots.

Disaster Response System Using IOT

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Abstract
The disaster threats to communities are very Real and these risks are often magnified when there is an Electoral cycle. Individuals can spend lots of time and Energy manually firing at disaster-related information, The outcome of which is undesirable in that searching is Sluggish and imprecise, hindering the fast emergency Response efforts. To solve this challenge in real time and During emergency events our initiative utilizes machine Learning and optimization techniques to automatically Detect disasters as they are happening. We use the Disaster response iot sensor dataset which is improved Using advanced iot data collection and analysis Techniques. Prior to the implementation, we process this Information by getting rid of the unnecessary terms, Reducing the words and converting them to their basic Forms. From the information that is processed, we Select the most important features and conduct multi Layered principal component analysis (pca) to Extract the features. After that we optimize these Attributes by using iot based Optimization component. The refined features then are fed Into the multi support vector machine (multi-svm) Framework harmonized with the iot based decision making Systems. Our approach provides 98% accuracy which is More accurate as compared to cnn-lstm iot hybrid Model has only 87% accuracy. Additionally, we incorporate real functionality, such as user Registration, sensors data upload functionality, realtime Disaster categorization and notification priority system for emergency management to ensure faster and more effective Emergency management response.
Keywords:- Disaster Response System using IoT, Sensor Networks, Cloud Computing, GPS tracking

Artificial Intelligence–Driven Transformation of 5G and 6G Mobile Networks: Architecture, Challenges, and Future Directions

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Abstract
Artificial Intelligence (AI) is increasingly becoming a foundational component of modern wireless communication systems, particularly in the evolution from fifth-generation (5G) to emerging sixth-generation (6G) mobile networks. The growing demand for ultra-reliable low-latency communication, massive connectivity, and intelligent automation has necessitated advanced network management approaches beyond traditional deterministic methods. This paper presents a comprehensive scholarly analysis of AI-driven transformation in 5G and 6G mobile networks, focusing on architectural evolution, operational implications, critical technical challenges, and future research directions. Unlike many existing studies that examine isolated applications of AI in wireless networks, this work provides a unified perspective linking architectural integration, autonomous network operation, and emerging AI-native communication paradigms. The analysis highlights the transformative potential of AI in enabling predictive optimization, adaptive resource allocation, intelligent security management, and autonomous network orchestration. Key challenges—including privacy preservation, computational scalability, explainability, interoperability, and sustainability—are critically discussed. The paper concludes that AI-native network architectures will be central to the realization of 6G communication ecosystems, supporting intelligent, selforganizing, and context-aware wireless infrastructures.
Index Terms:- Artificial Intelligence, 5G Networks, 6G Communication, Intelligent Networking, Network Automation, Wireless Communication.

Improving Digital Forensic Security with a Secure Storage Model with Authentication and Optimal Key Generation Based Encryption

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Abstract
A major part of the current investigations of cybercrimes has involved digital forensic analysis, and a secure digital forensic evidence storage and examination would play a key role at present. The challenges associated with cloud storage and transmission however include unauthorized possession, manipulation, and destruction of digital evidence during forensics. This paper will therefore present a strategy of resolution to this problem using the Secure storage Model that incorporates Authentication and Optimal Key Generation Based Encryption. It is an approach, which involves Blockchain technology as well as Homomorphic encryption one and is founded on the Enhanced Equilibrium Optimizer (EEO) which ensures the key is created in a way that is the most optimal. In addition to this, it utilizes Secure Block Verification Mechanism (SBVM), which causes the digital forensic evidence not to be disrupted in different connected nodes. Based on the outcome of the simulation, the specified model is useful in enhancing confidentiality, reliability, and security of digital forensic evidence when compared with the existing storage solutions.
Keywords:- Digital Forensics, Secure Storage, Cloud Security, Authentication, Optimal Key Generation, Encryption, Blockchain.

Human Face Generation Using DCGAN

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Abstract
Generative Adversarial Networks (GANs) have made impressive progress in the field of generative modeling and especially in the field of creating realistic images using generative adversarial networks. Among their different uses, the creation of human faces has attracted much attention, since a GAN-based model can produce highly realistic facial images that do not belong to any existing person. This research focuses on the development of Deep Convolutional Generative Adversarial Network (DCGAN) for creating high quality synthetic human face image. The DCGAN model makes use of convolutional neural networks within the generator and discriminator architectures which helps in increasing the quality of the images and also maintaining the stable training behavior. Using large-scale facial datasets such as CelebA, the model is capable of learning about detailed structures of faces as well as learning about representations of facial features in space and producing diverse and talking faces. The experimental results have shown that DCGANs have been effective in generating photorealistic human faces that can be used in applications such as digital entertainment, virtual character generation, gaming, and data augmentation for machine learning tasks. In addition, several common training problems such as mode collapse and instability are addressed in this work and architectural design and optimization strategies contributing to stable training and improved quality of visual output are discussed.
Keywords:- Synthetic Face Generation, Deep Learning Techniques, Deep Convolutional GAN (DCGAN), Generative Adversarial Networks, Image Generation, Computer Vision Systems, Artificial Intelligence.

Analytical Perspectives on Edge AI: Enhancing Real-Time Processing for Smart Systems

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Abstract
Edge Artificial Intelligence (Edge AI) is revolutionizing real-time data processing by enablingAI computations directly on edge devices, reducing latency, enhancing efficiency, and improving security. Unlike traditional cloud-based AI systems, Edge AI brings intelligence closer to the source of data generation, making it crucial for time-sensitive smart applications such as autonomous vehicles, industrial automation, healthcare monitoring, and smart cities. The significance of Edge AI lies in its ability to process large volumes of data instantly, ensuring real-time decision-making and minimizing dependency on cloud infrastructures.Its aims to analyze the impact of Edge AI on real-time processing within smart systems, focusing on its benefits, limitations, and future potential. The study explores various Edge AI frameworks, hardware implementations, and performance metrics to determine their effectiveness in different domains. Key research questions addressed includeHow does Edge AI improve real-time processing in smart systems compared to traditional cloud-based AI. What are the major challenges in implementing Edge AI across different industries. How can Edge AI be optimized for better efficiency, security, and scalability. What are the emerging trends and future advancements in Edge AI technology.

Exploring sustainable consumption through voice assistants: The role of personal ecological norms, attitude, and intention

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Abstract
The growing integration of intelligent digital technologies into everyday life has positioned voice assistants as influential tools in guiding consumer decision-making. Beyond convenience, these voice assistants possess the potential to encourage environmentally responsible choices by offering energy-saving guidance and suggesting sustainable product alternatives. However, limited research has examined the psychological processes through which voice assistants foster sustainable consumption. To address this gap, the present study adopts an integrated framework grounded in the Norm Activation Model (NAM) and the Theory of Planned Behavior (TPB) to explore the determinants of sustainable consumption behavior in the context of voice assistant usage. Specifically, the study investigates the roles of awareness of consequences, ascription of responsibility, personal ecological norms, attitudes toward voice assistants, and behavioral intention in shaping sustainable consumption behavior. The results demonstrate that awareness of environmental consequences and ascription of responsibility significantly strengthen individuals' ecological norms and cultivate favorable attitudes toward voice assistants. These internalized norms and positive attitudes subsequently enhance users' intention to engage with voice assistants, which ultimately translates into more sustainable consumption practices. The findings contribute to the emerging discussion on AI-enabled sustainability by clarifying the behavioral pathways linking voice technology adoption and environmentally responsible consumption.

Keywords: Voice Assistants, Sustainable Consumption Behavior, Environmental Responsibility, Behavioral Intention

Improving Digital Forensic Security with a Secure Storage Model with Authentication and Optimal Key Generation Based Encryption

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Abstract
A major part of the current investigations of cybercrimes has involved digital forensic analysis, and a secure digital forensic evidence storage and examination would play a key role at present. The challenges associated with cloud storage and transmission however include unauthorized possession, manipulation, and destruction of digital evidence during forensics. This paper will therefore present a strategy of resolution to this problem using the Secure storage Model that incorporates Authentication and Optimal Key Generation Based Encryption. It is an approach, which involves Blockchain technology as well as Homomorphic encryption one and is founded on the Enhanced Equilibrium Optimizer (EEO) which ensures the key is created in a way that is the most optimal. In addition to this, it utilizes Secure Block Verification Mechanism (SBVM), which causes the digital forensic evidence not to be disrupted in different connected nodes. Based on the outcome of the simulation, the specified model is useful in enhancing confidentiality, reliability, and security of digital forensic evidence when compared with the existing storage solutions.
Keywords:- Digital Forensics, Secure Storage, Cloud Security, Authentication, Optimal Key Generation, Encryption, Blockchain

AI-Integrated Renewable Energy and Low-Power Circuit Optimization for Sustainable Electronics Education Infrastructure

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Abstract
The growing energy demand of electronics education infrastructure—comprising laboratories, computing facilities, prototyping units, and testing environments—has significantly increased institutional carbon emissions. Addressing this challenge requires an integrated strategy that combines renewable energy adoption with intelligent low-power system design. This study presents an AI-integrated framework for renewable energy management and low-power circuit optimization aimed at developing sustainable electronics education infrastructure. The proposed framework leverages artificial intelligence techniques for real-time energy forecasting, load balancing, and optimal utilization of on-site renewable sources such as solar photovoltaic systems and battery storage. In parallel, AI-assisted electronic design automation (EDA) tools are utilized to optimize circuit architectures, reduce switching and leakage losses, and minimize overall power consumption in student-developed and research-oriented hardware systems. Simulation and analytical modeling indicate that the combined renewable–AI–low-power optimization strategy can reduce grid dependency by up to 35%, lower laboratory energy consumption by approximately 25%, and significantly decrease carbon intensity per experimental cycle. Additionally, virtualization techniques and digital prototyping further contribute to material and energy savings. The results demonstrate that integrating AI-driven renewable energy management with sustainable circuit design offers a scalable and cost-effective pathway toward low-carbon and energy-resilient electronics education systems. The proposed framework supports institutional sustainability goals and advances the transition toward net-zero academic engineering environments.

Empowering Inclusive Education through ICT: Artificial Intelligence and Green Innovation for Building Climate-Conscious Education Systems

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Abstract
In the rapidly evolving digital landscape of the 21st century, Information and Communication Technology (ICT) has emerged as a pivotal tool for fostering inclusive education. This paper explores strategies for capacity building and promoting digital equity to empower diverse learners, including marginalized and differently-abled students. The integration of ICT in educational settings offers opportunities to bridge gaps in access, enhance personalized learning, and foster active participation for all students. However, disparities in technological infrastructure, digital skills, and resource availability pose significant challenges to achieving true inclusivity. The study examines various capacity-building initiatives such as teacher training programs, digital literacy campaigns, and community engagement efforts aimed at equipping educators and learners with essential skills. Additionally, it underscores the importance of policy frameworks and collaborative efforts among stakeholders to ensure equitable access to digital resources and infrastructure. The paper highlights successful case studies and innovative practices that demonstrate how ICT can be leveraged to create inclusive learning environments. It emphasizes the need for a holistic approach that combines technological solutions with pedagogical reforms, emphasizing culturally responsive and accessible content. Furthermore, the research advocates for continuous monitoring and evaluation to adapt strategies effectively. Ultimately, empowering inclusive education through ICT requires concerted efforts to address infrastructural, pedagogical, and socio-economic barriers, ensuring that every learner has the opportunity to realize their full potential in an increasingly digital world. This paper contributes to the ongoing discourse on digital equity and provides practical insights for policymakers, educators, and stakeholders committed to fostering inclusive and equitable education systems in the 21st century.

Optimizing the Energy Transition through Intelligent Grid Architectures

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Abstract
Beyond Static Infrastructure: Leveraging Advanced Analytics for the Decarbonization of Power Systems The global transition toward a low-carbon economy relies heavily on the integration of intermittent renewable energy sources, such as wind and solar, into aging electrical infrastructures. However, the inherent volatility of these sources poses significant risks to grid stability and frequency regulation. By utilizing high-frequency sensor data and predictive modeling, modern grid architectures can now move beyond reactive management. We examine the implementation of Automated Demand Response (ADR) systems that synchronize industrial and residential consumption with real-time generation peaks. Furthermore, the study highlights the role of Virtual Power Plants (VPPs) in aggregating distributed energy resources—including electric vehicle fleets and localized battery storage—into a cohesive, resilient energy ecosystem. By improving short-term load prediction by as little as 3% to 5%, grid operators can significantly lower the operational carbon intensity of the entire network. The conclusion argues that the energy transition is not merely a hardware challenge of building more panels and turbines, but a computational challenge of managing complexity at scale.

AI-Driven Workload Scheduling and Emission Optimization in Academic Cloud-Based Data Science Platforms

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Abstract
The increasing reliance on cloud-based platforms and high-performance computing in academic Data Science departments has led to significant energy consumption and associated carbon emissions. Managing the computational workload of virtualized servers and GPU clusters efficiently is critical to reducing environmental impact without compromising research and instructional quality. This study presents *"AI-Driven Workload Scheduling and Emission Optimization in Academic Cloud-Based Data Science Platforms,"* a framework that leverages artificial intelligence (AI) to optimize energy usage, carbon emissions, and resource utilization in academic cloud infrastructures. The proposed system uses AI algorithms for real-time monitoring, predictive workload allocation, and carbon-aware scheduling, dynamically distributing computational tasks across cloud servers and GPU clusters based on energy efficiency, renewable energy availability, and carbon intensity of the electricity grid. Techniques such as adaptive GPU scaling, mixed-precision computation, virtualization, and idle-power minimization are integrated to reduce operational emissions. Additionally, the framework incorporates a lifecycle-based carbon accounting approach to capture both operational (Scope 2) and embodied (Scope 3) emissions associated with cloud infrastructure and hardware. Simulation results indicate that AI-driven workload scheduling can reduce energy consumption by 25–40% and lower carbon emissions per task significantly, while maintaining high computational performance and throughput. The study demonstrates that intelligent workload management combined with emission-aware cloud orchestration provides a practical and scalable pathway for developing sustainable, low-carbon academic Data Science platforms.

Keywords: AI-Driven Workload Scheduling, Carbon-Aware Cloud Computing, Sustainable Data Science Infrastructure, GPU Optimization, Energy Efficiency, Academic Cloud Platforms, Lifecycle Carbon Assessment.

Carbon-Aware Machine Learning Infrastructure: An AI-Integrated Sustainable Framework for Academic Data Science Ecosystems

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Abstract
The rapid expansion of machine learning research and cloud-based computing in academic Data Science ecosystems has led to substantial increases in energy consumption and carbon emissions, primarily due to GPU-intensive workloads, large-scale data storage, and continuous server operation. To address these sustainability challenges, this study proposes *"Carbon-Aware Machine Learning Infrastructure: An AI-Integrated Sustainable Framework for Academic Data Science Ecosystems,"* a holistic approach that combines intelligent resource management, renewable energy integration, and curriculum-level sustainability practices. At the educational level, a curriculum-integrated carbon governance model embeds green computing principles, energy-efficient algorithm design, and lifecycle-based carbon assessment into laboratory exercises and research projects. Simulation and analytical modeling indicate that the proposed framework can reduce operational energy consumption by 30–45% and significantly lower carbon intensity per machine learning task, while extending hardware lifespan and promoting environmentally responsible computing behavior among students and researchers. The study demonstrates that integrating AI-enabled infrastructure optimization with sustainable educational practices provides a scalable pathway for developing low-carbon, resilient, and energy-efficient academic Data Science ecosystems.

Marketing Sustainability in the Age of AI: Consumer Perceptions of AI-Optimized Green Products.

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Abstract
As artificial intelligence (AI) becomes deeply integrated into product development and supply chains, a new category of goods is emerging: **AI-optimized green products**. These are sustainable products whose eco-friendly credentials (e.g., reduced carbon footprint, waste minimization, energy efficiency) are achieved or enhanced through AI-driven processes. However, the intersection of "high-tech" and "high-green" presents a unique paradox for marketers. While AI can solve complex sustainability problems, consumer perception of these products is not yet fully understood. This paper investigates the cognitive and emotional responses of consumers to sustainability claims that are framed as being "AI-enabled." Utilizing a mixed-method approach involving experimental surveys and neuroscientific (EEG) analysis, we explore how the attribution of a product's green benefits to AI algorithms (versus traditional methods) affects perceived trust, brand authenticity, and purchase intention.Our preliminary findings reveal a dualistic consumer landscape. On one hand, a segment of "Tech-savvy environmentalists" views AI optimization as a superior, data-driven validation of sustainability, enhancing perceived efficacy. On the other hand, a significant "Skeptic" segment experiences a "Tech-Green Gap," where the intervention of AI reduces the perceived naturalness and authenticity of the product, triggering feelings of "green washing" skepticism. The study identifies **algorithmic transparency** and **human-centered messaging** as critical moderators; consumers respond more favorably when the AI's role is framed as assisting human ethical decision-making rather than replacing it.This research contributes to the literature on sustainable consumption and human-computer interaction by mapping the neural and psychological correlates of AI-mediated green trust. For practitioners, it provides a framework for navigating the "automation paradox" in sustainability marketing, suggesting that brands must communicate not only *what* AI saves, but *why* the human-machine collaboration matters for the planet.

Investigation of Gas Sensing Mechanism of Gas Nanosheet for Co Detection: A DFT Approach

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Abstract
In this theoretical study the adsorption mechanism of carbon monoxide (CO) on 2D monolayer of Gallium Sulphide (GaS) is investigated systematically using density functional theory (DFT). We used VASP (Vienna Ab- initio simulation package) for DFT calculations and VESTA (Visualisation for electronic and structural analysis) for construction and visualisation of material and molecule. Generalized gradient approximation (GGA) is used to get exchange correlation energy of system. Our study suggests that substrate material is a semi-conducter with indirect band gap of 2.40 eV. Calculated adsorption energy is -0.0721eV. Weak interaction between CO and GaS suggests that pristine GaS monolayer is not suitable for effective detection of CO gas however it is a sign of rapid desorption which can be favourable for sensing application.

Theological Ethics and Artificial Intelligence: Reimagining Sustainable Development in Zimbabwean Urban Communities

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Abstract
The rapid expansion of Artificial Intelligence (AI) technologies across the globe presents both unprecedented opportunities and profound ethical challenges for developing societies. In Zimbabwean urban communities, where economic instability, unemployment, digital inequality, and governance concerns intersect, AI holds transformative potential for sustainable development. However, without ethical guidance rooted in contextual realities, AI risks reinforcing inequality, marginalising vulnerable populations, and deepening socio-economic divides. This paper explores how theological ethics can provide a critical framework for evaluating and guiding AI integration in Zimbabwean urban contexts. This study employed a qualitative interpretivist design using semi-structured interviews and focus groups with purposively selected stakeholders from diverse sectors in Zimbabwean urban communities to examine the ethical, theological, and governance dimensions of AI in sustainable development.Drawing from Christian social ethics, African communal philosophy, and sustainability discourse, the study argues for a justice-oriented, human-centered approach to AI development. The paper demonstrates that theological ethics offers normative resources such as human dignity, stewardship, justice, and communal responsibility that can reimagine sustainable development beyond technocratic efficiency. It concludes by proposing an ethically grounded model for AI governance that prioritizes equity, accountability, and community empowerment in Zimbabwe's urban transformation.

Detection, Analysis, and Tracking of Breast Cancer Through Deep Learning Algorithms: A Systematic Review

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Abstract
Early detection of breast cancer is critical for reducing mortality and improving patient survival through in time diagnosis and dynamic tracking of the disease. Mammography is a widely used imaging modality for breast cancer screening. It is considered as an effective technique for detecting structural abnormalities in breast tissues. The major challenges remain as manual interpretation of mammographic images. To address these complex challenges, computer-aided detection and diagnosis systems based on advanced computational techniques like convolutional neural technique and support vector machine have been developed for automated analysis. This paper focuses on studying various deep learningalgorithms to detect, analyse, and track suspicious lesions, masses, and micro-calcifications in mammographic images. It analyses current methodologies, datasets, and performance evaluation strategies, and highlights their potential to enhance diagnostic accuracy, improve screening efficiency, and support radiologists in clinical decision-making.
Keywords:- Breast cancer, medical imaging, deep learning

Optical Wireless Communication for Sustainable Development: A Green Technology for Energy-Efficient Future Networks

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Abstract
The exponential rise in the demand for high speed wireless communication makes the system nonlinear, energy inefficient and eventually raises the concern for electromagnetic pollution. Growing data traffic, spectrum congestion, infrastructure densification, electromagnetic interference are the major issues faced by the traditional radio frequency (RF) systems. Optical Wireless Communication (OWC) technology including Visible Light Communication (VLC), Free Space Optics (FSO), Light Fidelity (LiFi)has emerged as a promising next generation green technology which is capable of addressing these challenges. Due to its vast unlicensed spectrum, OWC uses optical spectrum for high speed data transfer rate, high energy efficiency, low electromagnetic interference while maintaining efficient communication networks. Recent advancements in hybrid RF-OWC architectures, energy aware network optimization using energy efficient modulation techniques are also discussed. This paper explores the contribution of OWC technologies towards global sustainability initiatives particularly in the field of affordable and clean energy, Industry, Innovation and Infrastructure, sustainable cities and communities and wireless communication. This paper concludes that OWC networks can play an important role for sustainable future communication ecosystems by reducing carbon footprints and fulfilling ultra-high data rate demands and hence can become a key component of next generation networks.

Keywords:- Optical Wireless Communication (OWC), Visible Light Communication (VLC), Free Space Optics (FSO), Light Fidelity (LiFi), Sustainable Development, Green Technology.

Predictive Parametric Analysis and Detection of Tuberculosis by Using Convolutional Neural Network Architecture

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Abstract
Tuberculosis is an infectious chronic obstructive pulmonarydisease that occurs due to the bacteria Mycobacterium tuberculosis. Elimination of TB requires early detection, belligerent treatment, and contact tracing. Currently, available techniques such as rapid molecular diagnostic tests, sputum smear microscopy, and chest X-rays cannot detect abnormal TB, resulting in widespread illness. This paper highlights the key variables to prioritize methods and provide a strong foundation for actionable recommendations to mitigate TB. In this project, initially, available TB datasets are to be trained in CNN architecture to design a customized model. The generated algorithm and designed architecture will be embedded in a deep learning-based computational device for easy diagnosis, reliability, and ease of accessibility for treatment in remote areas. Further, machine learning clubbed up with deep learning to form a robust hybrid artificial intelligence-based diagnosis technique. This project uses machine learning tools like Google Colab, Jupyternotebookand ML/DL libraries like Tensorflow, Keras, and Scikit learn.

Keywords:- CNN (Convolution Neural Network), ML (Machine Learning), DL (Deep Learning), TB(Tuberculosis)

Additive Manufacturing, A Revolutionary Approach in Manufacturing

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Abstract
Using a layer-by-layer deposition process straight from digital models, additive manufacturing (AM) is an advanced manufacturing technique that makes it possible to produce complicated components. Wire and arc additive manufacturing (WAAM) has garnered significant interest among metal AM techniques because of its high material deposition rate, low production cost, and capacity to build large-scale metallic products. Because WAAM uses metal wire as the feedstock and an electric arc as the heat source, it is an effective technique that may be employed in industrial settings including shipbuilding, automotive, and aerospace. large-scale metal production using additive manufacturing.Even with these benefits, maintaining part quality and dimensional precision is still quite difficult. The bead shape, microstructure, and mechanical characteristics of the deposited material are significantly influenced by process variables such heat input, arc stability, travel speed, wire feed speed, and interlayer temperature. Defects including porosity, distortion, residual strains, and poor surface quality can result from variations in these characteristics. Achieving accurate and dependable components also requires maintaining constant deposition and regulating layer height during multi-layer manufacturing. Therefore, to increase the quality and reproducibility of WAAM-produced components, sophisticated monitoring systems, process optimization approaches, and enhanced toolpath strategies are needed. The industrial use of additive manufacturing for large-scale metal fabrication will increase with more study and technical advancement.

Practical Insights for Action-Oriented Sustainability

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Abstract
The accelerating climate crisis has intensified the need for scalable, system-level approaches to carbon reduction across energy, industry, transport, agriculture, and institutional governance. Artificial Intelligence (AI) is increasingly positioned as a transformative enabler of sustainability transitions, yet its role remains conceptually fragmented across disciplines. This paper presents an integrative literature review examining the contribution of AI to carbon footprint reduction and sustainable systems optimization. Drawing on peer-reviewed research, institutional reports, and foundational theoretical works, the review synthesizes evidence across five thematic domains: carbon measurement and intelligence, sectoral optimization, behavioural and governance mechanisms, rebound effects, and Green AI.The findings indicate that AI functions most effectively as an operational intelligence layer embedded within broader policy and infrastructure systems, enhancing predictive capability, resource efficiency, and adaptive management. However, the literature also highlights critical challenges, including rebound dynamics, computational energy consumption, governance gaps, and equity considerations. The review identifies emerging research gaps, particularly in longitudinal impact assessment and Global South implementation contexts. By integrating technical, environmental, and socio-economic perspectives, this paper provides a structured framework for understanding both the potential and the limitations of AI-driven sustainability strategies, contributing to the evolving discourse on responsible digital transformation for climate mitigation.

Keywords:- Artificial Intelligence; Carbon Reduction; Sustainability; Green AI; Rebound Effect; Climate Governance; Digital Optimisation

Green House Monitoring System by Using IOT

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Abstract
In the case of the greenhouse being organized in an agricultural manner, this Smart Greenhouse Monitoring System is an IoT based system, which senses and controls greenhouse environments under a smart monitoring strategy. It is a system of sensors, microcontrollers and web technologies that control the key environmental parameters i.e. temperature, humidity, soil moisture, light levels, and gas levels in real-time. The centralized computer-based interface which is offered in the system also enables the farmers and those in authority to remotely control the conditions of the greenhouse thus not requiring any manual work and generation of human errors as it is common in the conventional systems of farming processes. The system supports valuable features like real-time data collection, sensor data visualization, automatic management of air conditioning and irrigation system, threshold-based alerting and historical analysis of past data etc. The greenhouse has sensors that collect data on the environment that are transmitted to a server by IoT communication protocols. With the defining requirements, water pumps, fans and artificial light actuators may be programmed under the control of optimal growing conditions. To provide the early warning against the occurrence of the over-reaching of the parameters to the safety levels the users are equipped with the mechanism.
Keywords:- IoT, Greenhouse Monitoring, Smart Agriculture, Environmental Sensors, Temperature and Humidity Monitoring, Soil Moisture.

Artificial Intelligence and Digital Learning Tools: Transforming Pedagogical Practices for School Teachers

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Abstract
The emergence of Artificial Intelligence (AI) and digital learning technologies has fundamentally reshaped contemporary educational practices. This expanded research study critically examines the pedagogical, administrative, and professional implications of AI-driven tools in school education. The paper analyzes classroom applications such as adaptive learning systems, intelligent tutoring platforms, automated evaluation tools, learning management systems, and AI-based content generation applications. Emphasis is placed on how these technologies support teachers in personalizing instruction, improving assessment accuracy, enhancing student engagement, and promoting inclusive education. Using qualitative analysis of secondary academic literature and policy reports, this study evaluates benefits, challenges, ethical concerns, and long-term implications of AI integration in schools. The findings suggest that while AI tools significantly enhance efficiency and learning outcomes, their effectiveness depends on teacher training, institutional readiness, digital infrastructure, and ethical governance. The study concludes that responsible and pedagogically informed implementation of AI can empower teachers and prepare students for participation in a technology-driven global society.

An Investigation on the Impact of Digitalization on Supply Chain Efficiency in the Manufacturing Industry: A Case of Bikita Minerals

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Abstract

The study examines how digitalisation is shaping operational efficiency, supply chain performanceand sustainability outcomes in manufacturing supply chains in rapidly evolving Industrial Landscapewith Bikita Minerals as a case study. Anchored within the sub-theme Sustainable Operations and Decision Analytics, the research examines how digital tools such as Artificial Intelligence (AI),Enterprise Resource Planning (ERP), data analytics systems, automation technologies, and real-time tracking platforms enhance operational visibility, optimize resource utilization, and support data-driven decision-making.This study investigates the impact of digitalization on operational efficiency, supply chain performance, sustainability outcome, and safety management within the manufacturing processes at Bikita Minerals—one of Zimbabwe's leading ,thus represents a significant case in understanding local application of digital technologies. Employing a mixed-method research design, this paper analyses quantitative production data involving regression and descriptive statistical techniques and qualitative insights from employee s, infrastructure limitations, and resistance to technological change among workers. The study contributes empirical evidence on the benefits and barriers of digital transformation in a resource-constrained mining context, offering actionable recommendations for policymakers, industry stakeholders, and future research. This research ultimately highlights digitalization as a pivotal driver for sustainable manufacturing growth in developing economies. However, progress is limited by technical constraints, skills shortages, and inconsistent infrastructure. The study concludes that although digitalisation has strengthened operational performance, greater investment in staff training, system integration, and supportive organisational policies is required to achieve full transformation. The study contributes to the sustainable operations literature by demonstrating that digital transformation is not merely a technological upgrade but a strategic enabler of environmentally and economically sustainable supply chain practices.

Keywords:- Digitalization, Sustainable Operations, Decision Analytics, Supply Chain Efficiency, and Manufacturing Industry.

Design of Milli-Metre Wave Based Wideband Micro-Strip Patch Antenna for 5G Communication Networks

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Abstract

The paper titled "The design of millimetre wave-based wide-band micro-strip patch antenna supporting ultra-low latency and ultra-fast bandwidth in autonomous system of 5G wireless communication networks" is proposed. This low-profile antenna of dimension 2.45×4.24 mm2 is placed on a Rogers RT/Duroid 5880 (tm) substrate with dielectric constant 2.2 and loss tangent of 0.009. This proposed front-end device is wide band in nature having a bandwidth of 26 GHz to 32 GHz with around 6dB return loss and VSWR less than 2. This antenna is perfectly resonating at 29 GHz having 14 dB return loss with a substantial difference in the co-polarization and cross-polarization and antenna efficiency. This antenna is suitable for dense urban infrastructure for high speed communication. Due to its mm-wave band of operation, it has inherent limitations, including a limited coverage range and high sensitivity to environmental effects, which lead to dispersion and fading. In the future, this antenna will be integrated in an array format for multiple-input, multiple-output-based communication.

Keywords:- 5G antenna, wide band antenna, patch antenna, autonomous system, ultralow latency

Smart Fire Detection and Surveillance System Using IoT

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Abstract
Fire accidents have been one of the greatest life, infrastructure and environmental dangers in residential, industrial, and commercial spheres. Traditional fire detection devices are largely based upon smoke or heat sensors that are only local signal providers and thus may cause a great deal of damage with delayed response. The present paper provides a Smart Fire Detection and Surveillance System based on the Internet of Things (IoT) technology to address these shortcomings. It is proposed to combine different environmental sensors, including flame, gas, and temperature sensors, with a module of the ESP32-CAM to provide the early fire warning, real-time monitoring, and visual surveillance. The sensor data will be constantly gathered, data processed, and relayed to cloud-based IoT applications, so alerts can be received in real-time through a mobile or a web platform. Situation awareness is enhanced by inserting real-time video surveillance, and false alarms are minimized. It is also a scalable, energy-efficient, and the cost-effective system applicable to smart homes, offices, industries, and infrastructures by the citizens.
Keywords:- IoT, Smart Fire Detection, Surveillance System, ESP32-CAM, Sensor Networks, Cloud Computing.

Integrating Heritage Knowledge with Modern Mechanical Engineering for Solar Energy Solutions

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Abstract
The growing demand for clean and sustainable energy has renewed interest in solar energy solutions, especially when combined with insights drawn from traditional and heritage-based knowledge systems. Many ancient civilizations used solar principles for heating, ventilation, and energy efficiency through architectural design, material selection, and natural thermal management. Integrating such heritage knowledge with modern mechanical engineering offers innovative pathways to develop efficient and culturally rooted solar energy systems. The first objective of this study is to examine how traditional solar and thermal practices can inform the design and performance of modern mechanical solar energy systems, particularly solar thermal technologies. The second objective is to analyze the role of mechanical engineering innovations in transforming heritage-based concepts into scalable and practical solar energy solutions. This study adopts a secondary data–based methodology, relying on published research articles, books, historical reports, and case studies related to solar energy, mechanical engineering, and traditional thermal practices. The collected data were reviewed and analyzed using a descriptive and comparative approach to identify patterns, synergies, and technological gaps. The findings reveal that heritage-inspired designs such as passive heating, natural airflow control, and thermal mass utilization can significantly enhance the efficiency and sustainability of modern solar systems when supported by advanced mechanical components and materials. The study also finds that blending traditional knowledge with modern engineering reduces energy losses, lowers system costs, and improves adaptability in diverse climatic conditions. In conclusion, the integration of heritage knowledge with modern mechanical engineering not only strengthens solar energy solutions but also promotes sustainable innovation rooted in cultural wisdom. The study highlights that such integration supports energy transition goals while preserving valuable traditional practices. Future implications of this research include the development of hybrid solar technologies, heritage-sensitive energy infrastructure, and policy frameworks that encourage interdisciplinary collaboration for long-term sustainable energy transformation.

Sustainable IT Solutions: Reducing Carbon Emissions through Smart Systems

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Abstract
Rapid digitalization and expanding IT infrastructure have significantly increased energy consumption and carbon emissions worldwide. Sustainable IT solutions, leveraging smart systems, offer an effective pathway to reduce environmental impact while maintaining operational efficiency. This study investigates the integration of intelligent technologies— including Artificial Intelligence (AI), Internet of Things (IoT), cloud computing, and data analytics—into IT systems to minimize carbon footprints and promote sustainable development. Smart IT systems monitor energy consumption in real time, optimize workload distribution, and automate resource allocation across data centers, enterprise operations, and urban infrastructure. AI-driven predictive analytics enable accurate forecasting of energy demand, dynamic scheduling of computational tasks, and early detection of inefficiencies in hardware and software utilization. IoT-enabled devices further enhance energy efficiency by providing granular data on energy use, environmental conditions, and equipment performance. Together, these technologies facilitate intelligent decision-making to reduce electricity consumption, minimize e-waste, and lower greenhouse gas emissions. The research highlights how sustainable IT practices, such as virtualization, cloud optimization, low-power computing, and smart energy management, contribute to measurable reductions in carbon emissions. Case studies of AI-optimized data centers and smart organizational networks demonstrate improved energy efficiency and cost savings while maintaining high system performance. The integration of carbon accounting metrics into IT dashboards allows organizations to track, report, and continuously improve environmental performance. The study concludes that smart, data-driven IT solutions are critical enablers of low-carbon operations, supporting both environmental and economic sustainability. By embedding intelligent monitoring, automation, and optimization into IT ecosystems, businesses, governments, and institutions can achieve scalable reductions in energy use and emissions, aligning technological innovation with global climate action goals.

Future of HRM with AI Integration

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Abstract
Human Resource Management is now making itself ready to take a shift towards integrating with artificial intelligence. In this scenario, HRD is now automating itself in the various fields of HR like, recruitment, selection, training & Development, talent management, reward management and many more. AI tools like analytics, chatbots and various algorithm are supporting various HR functions. While we go through benefits of AI but there are few challenges of using AI. The study will focus of various aspects of HR with its benefits and challenges.

Keywords: HRM, Human Resource Management, Artificial Intelligence, AI, HR function and practices

Harnessing AI for MSME Empowerment: Driving Innovation and Inclusive Growth

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Abstract
Micro, Small, and Medium Enterprises (MSMEs) are vital engines of economic growth, employment generation, and innovation across the globe. However, they often face challenges such as limited access to technology, finance, and market reach, hindering their potential for sustainable development. Harnessing Artificial Intelligence (AI) presents a transformative opportunity to address these challenges and catalyze MSME empowerment. This paper explores the integration of AI-driven solutions to enhance MSME competitiveness, operational efficiency, and inclusivity. It discusses how AI technologies—such as machine learning, natural language processing, and predictive analytics—can facilitate smarter decision-making, personalized customer engagement, and streamlined supply chain management. The paper also highlights case studies demonstrating successful AI adoption in MSMEs across various sectors, emphasizing the role of accessible AI tools and government initiatives in fostering a digital ecosystem tailored for small enterprises. Furthermore, it examines the potential of AI to promote inclusive growth by bridging gaps for marginalized groups, enabling access to finance, and expanding market opportunities. Challenges related to data privacy, digital literacy, and infrastructural limitations are critically analyzed, along with strategic recommendations for policymakers, industry stakeholders, and entrepreneurs to leverage AI ethically and effectively. The findings underscore that strategic deployment of AI can significantly accelerate MSME innovation, improve resilience, and contribute to sustainable economic development. Ultimately, harnessing AI for MSME empowerment not only drives technological advancement but also fosters inclusive growth, ensuring that the benefits of the digital economy reach the grassroots level.

Fostering Trust and Transparency: Responsible AI Governance for Green Commerce and Emission Reduction

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Abstract
In the rapidly evolving landscape of digital commerce, the deployment of Artificial Intelligence (AI) systems offers unprecedented opportunities for innovation, efficiency, and customer engagement. However, the widespread adoption of AI also raises critical ethical concerns related to trust, transparency, and accountability. This paper explores the importance of fostering trust and transparency in AI-driven commercial environments by examining the principles of ethical AI development and implementation. It discusses how transparent algorithms, explain ability, and bias mitigation contribute to building consumer confidence and promoting responsible business practices. Case studies highlight successful strategies employed by organizations to enhance AI transparency and ethical considerations, illustrating the tangible benefits of responsible AI adoption. The paper emphasizes that fostering trust through ethical AI not only mitigates risks such as bias, discrimination, and privacy violations but also creates sustainable competitive advantages for businesses committed to responsible innovation. Ultimately, this research advocates for a comprehensive approach integrating technical, ethical, and legal dimensions to develop AI systems that are trustworthy, fair, and aligned with human values. As AI continues to reshape commerce, prioritizing ethical principles and transparency will be crucial for fostering consumer trust, enhancing brand reputation, and ensuring the long-term success of AI-enabled commercial practices.

AI-Driven Sustainable Business Models for Circular Economy Transformation

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Abstract
This paper aims to synthesise the literature on AI-based sustainable business models for the circular economy transformation. AI technologies like machine learning, deep learning, natural language processing, and predictive analytics are seen to be applied across various circular economy domains like supply chain management, waste management, product design, etc. This paper reveals how AI technologies can help businesses overcome the major challenges to the implementation of circular economy business models by increasing the efficiencies of the businesses through the application of AI technologies. Some of the challenges to the implementation of AI technologies for the circular economy transformation include issues of data privacy, the high cost of implementing AI technologies, the lack of skills among the workforce to implement AI technologies, and the phenomenon of the digital divide between large-scale businesses and small and medium-scale businesses. The contribution of this work is to give an integrated view of the relationship between AI and circular business models, as well as to highlight the conditions under which AI can support sustainability most effectively.
Keywords:- Artificial Intelligence; Circular Economy; Sustainable Business Models; Machine Learning.

Blockchain Based Framework for Traffic Event Verification in Smart Vehicles

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Abstract
Smart vehicles are becoming an important part of modern transportation as car manufacturers continue to develop vehicles that can sense their surroundings and communicate with one another. While these technologies have many advantages, there are also challenges associated with their use, including ensuring that sensors are reliable, making sure that vehicles can communicate with each other quickly and reliably, and keeping vehicle systems safe from cyber threats. This work proposes a new methodology for road safety improvement using the blockchain technology. In the proposed system, vehicles would constantly be observing the state of conditions on the road and report dangerous conditions such as accidents or dangers to a shared blockchain network. Once the system can figure out a problem then it will send out warnings to the surrounding vehicles and even bring them down in order to help prevent accidents from occurring. The system was tested using some realistic 3D simulation and a blockchain platform called Hyperledger Besu. The results show that the framework can handle growing numbers of vehicles and pieces of data in an efficient manner, and thus be suitable for use in the real world. Most importantly, the system is faster to react to the dangerous situations than are human drivers, which exhibit the potential of this technology to contribute an enormous amount to reduce road accidents and a greater level of safety on the roads.
Keywords:- Smart vehicles, Internet of Vehicles (IoV), Blockchain, Automobile accidents prevention, road safety, vehicle communication, Hazard detection, autonomous speed control, Hyperledger Besu, Intelligent transportation systems.

AI-Powered Strategies for Achieving a Greener Planet

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Abstract

Artificial Intelligence (AI) is emerging as a powerful tool for addressing environmental challenges and promoting sustainable development. As global concerns about climate change and environmental degradation increase, AI-powered strategies offer innovative solutions for achieving a greener planet. By analyzing large volumes of environmental data, AI can help identify patterns, predict climate trends, and support informed decision-making for reducing carbon emissions and improving resource efficiency. One of the key applications of AI is in energy management, where smart algorithms optimize energy consumption in buildings, industries, and transportation systems. AI-driven smart grids can balance electricity supply and demand, integrate renewable energy sources, and reduce energy waste. Furthermore, AI supports environmental monitoring through satellite imagery, sensors, and data analytics. These technologies help track deforestation, air pollution, and biodiversity changes in real time, allowing governments and organizations to respond quickly to environmental threats. AI is also being used to design sustainable urban planning solutions, improve waste management systems, and promote circular economy practices. Overall, AI-powered strategies play a significant role in supporting sustainability and climate action. By combining technological innovation with environmental responsibility, AI can contribute to reducing carbon footprints and building a more resilient, sustainable future for the planet.

Sustainable Additive Manufacturing of Recycled Polymeric Waste: Process Optimization, Material Characterization, and Life Cycle Performance Evaluation

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Abstract

The exponential growth in global polymer consumption has intensified environmental degradation and generated significant socio-economic and public health concerns. Consequently, there is a pressing need for sustainable production systems, responsible consumption patterns, and efficient end-of-life management strategies for plastics. Additive manufacturing (AM), or three-dimensional printing, offers a decentralized and resource-efficient fabrication platform characterized by reduced material waste, shortened lead times, and lower prototyping and development costs. The integration of circular economy principles with AM enables distributed recycling and closed-loop material flows, facilitating the valorization of post-consumer and post-industrial polymer waste into functional components. However, challenges such as polymer degradation, property retention, contamination, rheological instability, and process–material compatibility must be systematically addressed to ensure reliable performance. This study presents a critical review of the literature to establish technical guidelines and propose a circular economy framework for AM utilizing recycled polymer feedstocks. It synthesizes insights on commodity polymer classifications, recycling technologies, material performance limitations, and process optimization strategies to support sustainable and scalable implementation of recycled polymer-based additive manufacturing systems.

Artificial Intelligence Adoption & Organizational Performance in Nepalese Service Sector Organizations

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Abstract
It is well established that Artificial Intelligence (AI) represents a major catalyst in transforming organizations and sustaining competitive advantage. Grounded on the foundation of ResourceBased View (RBV) and Dynamic Capabilities Theory, this study scrutinizes the role of AI adoption in devising organizational performance among Nepalese service sector organizations. In December 2025, a quantitative cross-sectional survey was distributed (n = 471 questionnaires), with the analysis of 398 usable responses performed using Structural Equation Modeling (SEM). Implications of findings. The results reveal that AI adoption has both a strong and beneficial impact on overall organizational performance. In particular, the effect of AI adoption is greater on non-financial performance measureslike operational efficiency, innovation capacity, quality of service and productivity of employeesthan on financial performance results. The findings imply that internal capabilities and adaptability of organizations are enhanced through AI which consequently leads to profitability. The model explains a significant variance in performance constructs, which confirms the strategic relevance of AI integration for service-oriented organizations. This research contributes to the academic literature by providing new evidence from an emerging economy setting and testing a multidimensional measure of performance. These results highlight AI adoption as an essential organizational capability to achieve sustainable growth and positions organizations competitively in a fast-evolving digital landscape.

Keywords: Artificial Intelligence Adoption, Organizational Performance, Financial Performance, Non-Financial Performance, Resource-Based View, Dynamic Capabilities, Service Sector, Nepal.

Smart Detection Maker and Monitoring System for Modern Agriculture based on IoT

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Abstract
Intelligent technology in agriculture has become not an unnecessary luxury, but a necessity, as it contributes to achieving higher crop yields and reduces the number of people who must do everything with their own hands. Thus, this project that I am undertaking establishes an IoT based smart detection and monitoring system in contemporary agriculture. It works by having components such as a soil moisture sensor, the DHT11 temperature and humidity sensor, an LCD display, a relay paired with a water pump, and the NodeMCU which is an ESP8266 microcontroller that takes care of the IoT component. The general concept here is to monitor soil moisture, temperature, and humidity in real time. In that manner, irrigation will be automatic depending on the situation at hand. Like when the moisture decreases to a certain level, the relay goes in action and switches on the water pump to ensure nothing is missed. The DHT11 sensor indulges into that as well, whereby the sensor checks the surrounding conditions to ensure that irrigation is just right. You can see the sensor readings right there on the LCD provided you are around. And using the NodeMCU, it is connected to the cloud, so you may, in fact, check it remotely. It is relatively simple when considering it. This system is relatively cheap to install, and it does not consume a lot of energy so it can run on small farms as well as larger farms with little problem. I believe that is one of the better aspects, as it will assist with saving water and simply make the farming more sustainable, even though the productivity will increase slightly. It is not all good, however, it appears to be a good step.

Keywords:- Smart Agriculture, Automated Irrigation, Soil Moisture Monitoring, NodeMCU (ESP8266), Real-Time Monitoring, Cloud Computing.

An Advanced Text Summarization Model Using Nlp Techniques And Feature Based Scoring

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Abstract
Text summarization has seen a growing importance as a result of the fast growth of information being available on the internet coupled with the requirements for fast consumption of such information available on the internet. Traditional summarization systems that are based on deep learning are often expensive, slow, and need complicated implementation. To cope with such difficulties, in this work, an advanced model of text summarization based on Natural Language Processing (NLP) techniques and sentence scoring model based on features of sentences, is proposed. The proposed system comprises many extractive summarization engines, like SpaCy, NLTK, Sumy LexRank and Gensim, which can be used for the analysis of linguistic elements, such as tokens frequency, semantic weight and sentence relevance. By utilizing a blend of these methods, the system probably creates brief and key summary without requiring models or GPU help. The light weighting enabled real-time processing capability, domain flexibility and improved readability compared to the single model solutions. Experimental results demonstrate the efficiency and coherence of the generated summaries by the proposed method and lessen the computational overhead, our method is an effective alternative to transformer-based summarization models.
Keywords:- Natural Language Processing (NLP), Text Summarization, Hooke Previous review scoring, Extractive Summarization, LexRank, SpaCy, NLTK, Gensim, Information Retrieval, Lightweight Summarization.

AI enabled Intelligent Transportation & Smart mobility using Visible light communication

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Abstract
The work of future vehicle networks and smart city systems is being transformed by intelligent transportation powered by AI and controlled by visible light communication (VLC) and smart mobility. VLC is based on LED lights such as automobile headlights and traffic signals to transmit interference free wireless communication between vehicles to vehicles (V2V), between vehicles and infrastructure (V2I), and between vehicles and anything else (V2X). This paper briefly reviews how AI and VLC have been used to solve problems related to the complexity and dynamism of VLC signals and their optical electrical channels, nonlinear behavior, as well as the performance influences of lighting conditions. In this paper, the use of AI in enhancing physical layer technologies, including channel modeling, adaptive modulation, error correction, MIMO configurations, smart channel equalization, and other technologies, is analyzed to make communication more stable and faster. The paper also examines how AI can be used to enhance communication protocols in vehicles to undertake real time safety activities such as emergency braking warnings, collision avoidance, vehicle platooning, and traffic lights management. In addition, we talk about intelligent mobility systems based on AI to process the information provided by VLC and make the traffic more efficient, less polluted, and connected autonomous vehicles.
Keywords: VLC, V2V, V2X,Mobility

AI & Sustainable Approaches for Reducing Carbon Footprint

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Abstract

In today's world, carbon emissions from industries, transport, and daily activities are pushing our planet to the limit. This paper looks at how artificial intelligence (AI) can team up with sustainable practices to lower the carbon footprint in real, practical ways. The main goal is to show simple AI tools and green methods that businesses, cities, and people can use right now to make a difference. We start by explaining what carbon footprint means—basically, the total greenhouse gases released from our actions. Then, we dive into AI's role. For example, AI-powered smart grids in energy sector predict power needs and cut waste by up to 15-20%, based on real cases from companies like Google. Machine learning algorithms analyze traffic data to optimize routes, reducing fuel use in logistics by 10-12%. In farming, AI sensors monitor soil and weather to cut fertilizer overuse, which lowers emissions from agriculture. Climate change and rising carbon emissions have become major global concerns. Reducing the carbon footprint of industries, cities, and individuals is now an important goal for sustainable development. In recent years, Artificial Intelligence (AI) has emerged as a useful tool that can help in addressing environmental challenges and improving sustainability practices. Sustainable approaches add strength here. Things like using renewable energy sources (solar, wind) with AI forecasting make power cleaner. Circular economy models—recycle, reuse, reduce—get a boost from AI that tracks waste and suggests better designs for products. We also cover urban planning: AI helps design green cities with more trees, efficient public transport, and smart buildings that save energy. Challenges exist, like high energy use by AI data centers, but solutions are emerging. Green AI focuses on efficient models that run on less power, and pairing them with carbon capture tech offsets emissions. Case studies include Singapore's smart nation project, where AI reduced city emissions by 8%, and Indian firms using AI for supply chain optimization to meet sustainability goals. However, while AI offers many benefits, it is also important to consider its own energy consumption and ensure that AI systems are designed and used responsibly. Sustainable AI practices can help balance technological progress with environmental protection. This paper highlights the role of AI in supporting sustainable strategies for reducing carbon footprints. It focuses on how AI-based solutions can help create more efficient systems, encourage responsible resource use, and contribute to a cleaner and more sustainable future.

AI-Based Healthcare Resource Optimization

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Abstract

Healthcare systems operate under persistent resource constraints—limited beds, workforce shortages, rising pharmaceutical costs, and energy-intensive infrastructure. Artificial Intelligence (AI) has emerged as a critical optimization layer capable of improving allocation efficiency, reducing waste, lowering operational costs, and indirectly reducing carbon emissions. AI-based healthcare resource optimization integrates predictive analytics, machine learning, operations research, and real-time data systems to enhance clinical throughput, supply chain performance, workforce scheduling, and infrastructure utilization. This paper provides a structured analysis supported by peer-reviewed and institutional references.

Data-Driven Strategies for Environmental Sustainability

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Abstract
Environmental sustainability has become a central focus for organizations, governments, and communities due to the escalating impacts of climate change and resource depletion. Data-driven strategies offer a powerful approach to achieving sustainability by leveraging the insights derived from large-scale data collection, analysis, and predictive modeling. This study explores how advanced analytics, Artificial Intelligence (AI), and big data frameworks can be utilized to monitor, manage, and reduce environmental impacts across multiple sectors. The research emphasizes the role of data in optimizing resource allocation, minimizing waste, and reducing greenhouse gas emissions. By integrating IoT sensors, smart monitoring devices, and environmental databases, organizations can track energy usage, water consumption and material flows in real time. Predictive analytics and machine learning models support proactive decision-making by forecasting demand, identifying inefficiencies, and simulating the environmental outcomes of various operational strategies. These data-driven insights enable sustainable planning in urban infrastructure, manufacturing, transportation, and supply chain management, ensuring that ecological objectives are embedded in everyday operations. Comparative analysis indicates that data-driven approaches can significantly reduce carbon emissions, enhance energy efficiency, and improve operational resilience. The findings highlight that combining data intelligence with strategic environmental planning creates scalable and replicable frameworks for sustainable development. By leveraging digital tools to inform environmental policy and operational practices, organizations can align technological innovation with ecological responsibility, fostering long-term sustainability and contributing to global climate action goals.

Keywords-Data-Driven Strategies, Environmental Sustainability, Artificial Intelligence, Predictive Analytics, Carbon Emission Reduction.

Smart Medical Devices for Energy Efficiency

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Abstract
Healthcare facilities are among the most energy-intensive building types globally. Hospitals operate continuously, rely on high-powered diagnostic and life-support equipment, and maintain strict environmental controls. As healthcare contributes approximately 4–5% of global greenhouse gas (GHG) emissions (Health Care without Harm & Arup, 2019), energy efficiency has become a strategic priority. Smart medical devices—integrating artificial intelligence (AI), embedded sensors, and Internet of Things (IoT) connectivity—offer measurable reductions in electricity consumption, operational costs, and carbon emissions. This paper examines technological mechanisms, lifecycle carbon implications, economic benefits, and governance frameworks, supported by peer-reviewed and institutional references.

Efficient Machine Learning Models for Solar Radiation Prediction Using Ensemble Techniques

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Abstract
Solar energy is a clean and sustainable source of power that plays a vital role in electricity generation. Despite its importance, direct measurements of solar radiation are often unavailable in remote regions due to the high cost and maintenance requirements of monitoring equipment. In such locations, predicting solar radiation becomes an effective alternative. In this work, an efficient forecasting model is proposed to estimate hourly solar radiation in a region characterized by both arid and humid climatic conditions. The model uses real-time meteorological data collected from a weather station situated within a university campus located away from the main urban area. A total of eleven meteorological parameters were recorded continuously from January to December 2023. To reduce data complexity and improve prediction efficiency, Principal Component Analysis (PCA) was applied, resulting in the selection of eight key variables that best represent the original dataset. Several machine learning algorithms were then trained and evaluated using these selected features to assess their predictive capability. Performance comparison across models was conducted to ensure reliability and robustness. Furthermore, ensemble learning techniques were employed to enhance forecasting accuracy by integrating multiple models. Among all approaches, the Stacking Regressor demonstrated superior performance, achieving an R^2 value of 0.92, an RMSE of 47.30 W/m², and an MAE of 18.27 W/m². These results indicate that the proposed approach is highly effective for solar radiation prediction in the studied climate region.

Keywords:- Solar Energy, Solar Radiation Forecasting, Renewable Energy, Machine Learning, Meteorological Data, Principal Component Analysis (PCA), Ensemble Learning, Stacking Regressor, Hourly Prediction, Performance Evaluation.

AI in Telemedicine and Carbon Reduction in Healthcare

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Abstract
The healthcare sector contributes approximately 4–5% of global greenhouse gas (GHG) emissions, creating a paradox in which systems designed to protect health simultaneously exacerbate environmental risks to population well-being. Telemedicine has emerged as a structural decarbonization strategy by reducing transportation-related emissions, facility energy demand, and unnecessary resource utilization. When augmented by artificial intelligence (AI)—including machine learning (ML), natural language processing (NLP), and predictive analytics—telemedicine becomes a high-efficiency, data-driven sustainability mechanism. This paper examines the environmental impact of AI-enabled telemedicine, its carbon reduction pathways, implementation models, and governance considerations, supported by contemporary academic and institutional literature.

Revolutionising Human Resources Practice in Zimbabwe: The Intersection of Management & AI

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Abstract
The rapid diffusion of artificial intelligence (AI) technologies is reshaping organisational management worldwide, with significant implications for human resource (HR) practice. In Zimbabwe, where firms operate within a volatile economic environment characterised by currency instability, skills shortages and regulatory flux, the integration of AI into HR systems presents both transformative opportunities and complex risks. This article critically examines the intersection of management and AI in revolutionising HR in Zimbabwe. Drawing on interdisciplinary literature in strategic management, information systems and organisationalbehaviour, the study adopts an interpretivist and conceptual research design to analyse how AI-driven tools can enhance recruitment, performance management, workforce analytics and employee engagement while addressing contextual constraints. The article proposes a context-sensitive framework that integrates technological capability, managerial competence, ethical governance and institutional readiness. Findings suggest that AI adoption in Zimbabwean HR functions remains nascent and uneven, constrained by infrastructural deficits, data governance gaps and resistance to change. However, where strategically deployed, AI has the potential to enhance decision-making quality, reduce bias, improve compliance and foster organisational resilience. The study concludes that sustainable HR transformation requires deliberate investment in digital infrastructure, regulatory reform, capacity building and ethical oversight.

Key words: artificial intelligence, human resource management, Zimbabwe, strategic management, workforce analytics, digital transformation

Role of DevOps in Modern Software Engineering

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Abstract
DevOps has emerged as a transformative approach in modern software engineering, bridging the long-standing gap between development and operations teams. By promoting collaboration, automation, continuous integration, and continuous delivery, DevOps accelerates the software delivery pipeline while improving reliability and product quality. This seminar report explores the evolution, key principles, and practical implementation of DevOps within contemporary software development environments. It highlights how DevOps practices enhance organizational agility, reduce deployment failures, and support rapid, iterative development cycles essential for today's competitive digital landscape. Additionally, the report examines modern DevOps tools, cultural changes, and real-world case studies that demonstrate its impact on scalability, performance, and innovation. Overall, DevOps represents a significant paradigm shift, enabling organizations to deliver software faster, more efficiently, and with higher customer satisfaction.

Natural Language Processing for Nepal Language

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Abstract
NLP is one of the fastest-growing areas within AI, allowing machines to understand, interpret, and generate human languages. Despite remarkable strides in global NLP, Nepali, one of the Indo-Aryan languages spoken by more than 30 million people, remains an under-resourced language. Poor availability of annotated corpora, lack of computational linguistic tools, limited speech datasets, and scarce funding for research have delayed the development of robust technologies in the NLP domain for Nepali. This extended seminar report presents a comprehensive, in-depth analysis of the evolution, research contributions, challenges, and opportunities in Nepali NLP. It includes a detailed literature review of 10 major research papers, analysis of the linguistic features unique to Nepali, description of the current technologies and datasets, and case studies of practical applications of Nepali NLP. Comparisons of different systems, such as rule-based, statistical, and neural models employed for different Nepali NLP tasks, are included, supported with tables and theoretical explanation. The report concludes with future research directions pertaining to Nepali-language pre-training, speech corpora development, multimodal datasets, transformer-based NLP architectures, and national-level collaborative initiatives that can provide a concrete foundation for future researchers, practitioners, and institutions interested in the advancement of Nepali NLP and the creation of meaningful AI tools for Nepali-speaking communities.

Version Control System and GitHub with its Implementation

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Abstract
A Version Control Systems (VCS), focusing on Git and the collaborative hosting platform GitHub. It traces the development of VCS from local and centralized systems to the current distributed model represented by Git, explaining its basic functions and terminology. The document highlights GitHub's importance as a social coding platform. It shows how it is particularly useful in educational settings for collecting assignments, managing team projects, and encouraging collaboration among students. A comparison of major Git-based hosting platforms, GitHub, GitLab, and Bitbucket, is presented. This section evaluates them based on features, user base, and business use. The report also covers emerging trends and technologies. It discusses AI-powered tools like GitHub Copilot and GitHub Spark, which are influencing the future of developer productivity. Lastly, it looks at the future of VCS, predicting more automation, closer integration with DevOps, and better security measures. The report concludes that Git and GitHub have fundamentally changed digital collaboration. They have become essential tools for reproducible research, modern software development, and technology education.
Keywords:- Version Control System (VCS), Git, GitHub, Distributed Collaboration, GitLab, Bitbucket, Cloud-Based Hosting, Educational Technology, GitHub Copilot

Cybersecurity Threats and Mitigation Strategies

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Abstract
Cyber security threats continue to grow daily in size, complexity, and frighteningly, endangering individuals, businesses, and even a nation itself in enormous proportions. Now we have every kind of bad software such as malware, ransomware, phishing, DDoS attacks, zero-day bugs and long-term APTs that exploit the vulnerabilities in our digital systems. The world is becoming digital more than ever and more devices and cloud services are interconnecting which gives attackers many more targets to hit. To ensure that everything is safe, we must have a multifaceted strategy that will combine technological solutions, legislative adjustments, and people-oriented strategies. Significant actions are strong encryption, dividing the network into parts, regularly updating the software, multi-factor authentication, monitoring threat intelligence, and embracing systems such as Zero Trust. In addition to that, educating users on risks and incident contingencies is central to reducing the risks and harm of cyber-attacks. Overall, this topic emphasizes the idea that we should have a complete, proactive approach toward cyber security to secure our information in an ever-meaner world on the web.

Introduction to Edge Computing & Use Cases

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Abstract
Edge computing has emerged as an essential computing approach that overcomes the limitations of traditional cloud-centric systems by bringing data processing closer to where data is generated. This seminar report offers a detailed exploration of edge computing, covering its architectural design, operational behavior, and its rapidly growing use across multiple sectors. Driven by the massive expansion of IoT devices and the need for real-time, low-latency performance, edge computing helps reduce network load, strengthen data privacy, and improve overall system responsiveness.The report examines the three-tier architecture—device, edge, and cloud—and highlights key performance features such as proximity, scalability, reliability, and efficient bandwidth usage. Through practical use-case analysis, it shows how edge computing is reshaping fields like industrial automation, healthcare monitoring, smart city solutions, and autonomous transportation. The literature review summarizes current research progress, including advancements in edge-AI, predictive maintenance, cyber-physical control, and emerging security techniques, while also identifying ongoing challenges in orchestration, standardization, and lightweight privacy-preserving computation. A comparative study of cloud, fog, edge, MEC, and MCC models further positions edge computing within the larger distributed computing landscape. The report also reviews major platforms, tools, and hardware technologies that support widespread edge deployment. Overall, the findings suggest that future developments will depend on deeper integration with 6G networks, more capable on-device AI, and stronger security frameworks supported by realistic testbeds and standardized performance benchmarks.

Keywords: Edge Computing, Internet of Things (IoT), Low Latency, Mobile Edge Computing, Fog Computing, Distributed Systems, Real-Time Processing, Edge AI, Smart Cities, Industrial IoT.

Dockers and Containers in Application Deployment

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Abstract
Containerization changed the game for software deployment. Over the last decade, it's made things more portable, efficient, and scalable and effective. Compare that to old-school virtual machines, and containers really do stand out. In this report, we dig into Docker, easily the best-known container platform out there, and its place in today's deployment workflows. We start from the basics, then look at major research: Merkel's "Docker: Lightweight Linux Containers for Consistent Development and Deployment" (2014); Potdar and team's deep dive into performance in 2020; and Patchamatla's 2022 work on performance and security in telecom setups. There's more, but these are the big ones. The approach here is straightforward: We pull together what the literature says and compare how containers and VMs stack up on things like speed, efficiency, security, and that all-important deployment time. Here's what shows up, containers use resources better, start up way faster, and fit perfectly into the fast-moving world of micro-services and cloud-native apps. On the other hand, VMs win out on isolation and security, so they're better for older systems or anything with strict compliance needs. There's also a section on what's new and next, especially around orchestrating containers and keeping them secure. At the end, we call out what's still tricky; container security isn't solved, hybrid setups are getting more common, and AI-driven orchestration is starting to matter. These are the key spots where future research can really make a difference.

Computer vision in real time surveillance

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Abstract
With the evolution of technology, ensuring people's safety and security all around the time constantly is a big challenge. We propose an advanced technique based on deep learning and artificial intelligence platform that can monitor the people, their homes and their surroundings providing them a quantifiable increase in security. We have surveillance cameras in our homes for video capture as well as security purposes. Our proposed technique is to detect and classify as well as inform the user if there is any breach in security of the classified object using the cameras by implementing deep learning techniques and the technology of internet of things. It can serve as a perimeter monitoring and intruder alert system in smart surveillance environment. This paper provides a well-defined structure for live stream data analysis. It overcomes the challenge of static closed circuit cameras television as it serves as a motion based tracking system and monitors events in real time to ensure activities are limited to specific persons within authorized areas. It has the advantage of creating multiple bounding boxes to track down the objects which could be any living or non-living thing based on the trained modules. The trespasser or intruder can be efficiently detected using the CCTV camera surveillance which is being supported by the real-time object classifier algorithm at the intermediate module. The proposed method is mainly supported by the real time object detection and classification which is implemented using Mobile Net and Single shot detector.

Integrating Sentiment Analysis with Machine Learning for Cyberbullying Detection

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Abstract
Due to the intensive growth of social media, to a high extent, cyberbullying is currently a major priority in the digital era, and thus, this constitutes an immediate need of an automated and fast-tracking detection system of such malicious behavior. The conventional techniques of filtering based on keywords do not contain enough strength to detect the abusive content at the preventative stage and are therefore not sufficient. In their current research, the authors present a new smart and intelligent cyberbullying detection system that is based on the combination of two mutually complementary methods: sentiment-aware text processing and under- supervised machine-learning models that also lead to increase the accuracy of identification. The methodological apparel includes textual normalization, linguistic features extraction, and sentiment polarity, hence supporting the differentiation of aggressive communication and neutral or supportive reactions. Resampling techniques are used in training the models in order to reduce the common unevenness of the data of online discussions. There area wide range of classification algorithms tested to measure and compare results between different cyberbullying types. Empirical findings show that when sentiment information is combined with machine-learning methods, there is a significant enhancement in the detection based on the same, whereas the same procedures do not markedly differ in terms of computational efficiency. The suggested approach does not only emphasize the importance of emotional context in identifying abusive behavior but also helps in establishing safer online communication spaces.
Keywords:- Cyberbullying Detection, Sentiment Analysis, Machine Learning, Social Media Text Analysis, Natural Language Processing (NLP), Text Classification.

Literature Study on Robust Machine Learning Methods for EEG Signal Analysis in Brain–Computer Interfaces

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Abstract
An EEG (electroencephalogram) is a painless test that records the electrical activity of the brain using small metal electrodes placed on the scalp, mainly to help diagnose epilepsy, seizures, sleep problems, and other brain disorders. It is generally very safe, with the main rare risk being that flashing lights or deep breathing during the test can trigger a seizure in someone who already has a seizure disorder. EEG signals are no stationary, low SNR, and easily contaminated by artifacts, so robust processing is essential. Brain cells communicate with tiny electrical impulses, and an EEG records these as wave patterns (brain waves) displayed as wavy lines on a monitor or paper. Doctors look for abnormal patterns (like spikes or sharp waves) that may suggest epilepsy, sleep disorders, brain tumors, stroke, infections, or encephalopathy. A technician measures the head and attaches multiple small metal discs (electrodes) to the scalp with paste or stickers; this does not hurt and does not give any shock. Machine learning, including SVMs, random forests and deep learning, has shown strong performance in classifying cognitive states from EEG, such as workload, emotion, or relaxation. However, many existing systems are either not real time, rely on high-density lab equipment, or are not optimized for practical deployment in engineering applications. There is a need for an accurate, computationally efficient EEG–ML pipeline that can classify mental workload levels in near real time using a limited number of channels, suitable for integration into adaptive human–computer interfaces.

Public Health Engineering Education in India: Current Scenario, Opportunities and Challenges

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Abstract
Public health engineering can play an important and significant role in solving environmental health issues. In order to confront public health challenges emerging out of environmental problems we need adequately trained public health engineers / environmental engineers. Considering the current burden of disease attributable to environmental factors and expansion in scope of applications of public health / environmental engineering science, it is essential to understand the present scenario of teaching, training and capacity building programs in these areas. Against this background the present research was carried out to know the current teaching and training programs in public health engineering and related disciplines in India and to understand the potential opportunities and challenges available. A systematic, predefined approach was used to collect and assemble the data related to various teaching and training programs in public health engineering / environmental engineering in India. Pre-service programs include diploma, degree (graduate) and post-graduate courses affiliated to various state technical boards, institutes and universities, whereas in-service training is mainly provided by Government of India recognized engineering and public health training institutes. Though trainees of these programs acquire skills related to engineering sciences, they significantly lack in public health skills. The teaching and training of public health engineering / environmental engineering is limited as a part of public health programs (MD Community Medicine, MPH, DPH) in India. There is need for developing teaching and training of public health engineering or environmental engineering as an interdisciplinary subject. Public health institutes can play an important and significant role in this regard by engaging themselves in initiating specialized programs in this domain.
Keywords:- Public health engineering, Environmental engineering, Public health education.

Artificial Intelligence for Circular Economy–Based Waste Management: Challenges, Applications, and Future Opportunities

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Abstract
The circular economy has emerged as a sustainable alternative to the traditional linear economic model by promoting efficient resource use, waste reduction, and environmental protection. However, the transition toward circular systems faces significant challenges, particularly in waste management, due to complex waste streams, limited resource recovery, high energy consumption, and a lack of data-driven decision-making. Artificial intelligence (AI) offers promising solutions to address these challenges by enabling smarter waste sorting, optimized collection routes, improved recycling processes, and predictive system management. This paper examines the role of AI in supporting circular economy practices at the micro, meso, and macro levels, with a particular focus on waste management. It reviews current challenges, explores AI-based applications including generative AI, smart bins, robotic sorting, and industrial symbiosis, and discusses ethical, social, and environmental concerns related to AI deployment. The study highlights how AI can enhance resource efficiency, reduce waste, and support closed-loop systems while emphasizing the importance of responsible implementation. The findings suggest that AI, when combined with supportive policies, human oversight, and sustainable energy use, can play a critical role in advancing circular economy goals and promoting long-term sustainable development.

The Psychological Impact of AI-Driven Climate Literacy on Sustainable Behaviour

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Abstract
AI-based climate literacy represents an innovative approach to education for sustainable development by integrating environmental science with psychology. This approach addresses the urgent need for climate-focused, action-oriented learning, seeking to reduce eco-anxiety while enhancing learners' confidence in addressing environmental issues.This paper investigates the role of Artificial Intelligence in enhancing climate literacy through adaptive learning systems. These systems manage cognitive load and employ data analysis alongside simulation-based instructional methods. By integrating real-time climate data and predictive models, AI facilitates learners' understanding of complex climate patterns while minimising cognitive overload. The study demonstrates that AI-driven educational frameworks support SDG 4 (Quality Education). They promote inclusive and personalised learning environments that cater to individual motivation and learning styles. At the same time, these frameworks contribute to SDG 13 (Climate Action) by utilising behavioural nudges to increase climate awareness and improve decision-making skills. The research also addresses ethical concerns, such as data governance, algorithmic bias, and equitable access, to ensure AI is used responsibly. Ultimately, the findings indicate that AI-based climate literacy effectively connects abstract scientific knowledge with real-world pro-environmental actions.
Keywords: Artificial Intelligence, Climate Literacy, eco- anxiety and sustainable development

Artificial Intelligence in Civil Engineering: A New Era of Carbon-Efficient Construction and Infrastructure

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Abstract
The civil engineering sector is a major contributor to global carbon emissions, driven by energy-intensive construction processes, material production, and operational energy consumption in buildings. As the demand for sustainable infrastructure grows, Artificial Intelligence (AI) presents new opportunities for reducing the carbon footprint of the built environment. This paper explores the application of AI technologies—such as machine learning, predictive modeling, and optimization algorithms—in civil engineering to promote carbon-efficient construction and infrastructure. By integrating AI with green building techniques, the construction industry can enhance resource efficiency, optimize energy performance, reduce material waste, and achieve long-term sustainability goals. Through a case study, this research demonstrates how AI can minimize both embodied and operational carbon emissions. The findings highlight AI's role in creating a new era of intelligent, low-carbon infrastructure that aligns with global decarbonization targets.
Keywords: Artificial Intelligence, Carbon Emissions, Sustainable Construction, Machine Learning, Smart Infrastructure, Optimization Algorithms, Civil Engineering

The Role of Green Logistics in Enhancing Sustainable Transportation through Artificial Intelligence in the Courier Industry: A Case of Zimbabwe Posts (Zimpost)

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Abstract
This study examines the role of green logistics in enhancing sustainable transportation by embracing Artificial Intelligence (AI) in the courier industry with Zimpost as the focal point. The research investigates the current green logistics practices, challenges, and opportunities for improvement in respect to Artificial Intelligence especially considering that green logistics strive to reduce carbon emissions, improve energy efficiency, achieve logistics optimization and minimize environmental harm across supply chains having in mind increasing concerns over environmental degradation and climate change globally. Recent global studies demonstrate that AI-powered systems such as route optimization, predictive analytics, and smart fleet management significantly lower fuel consumption and emissions while enhancing service quality. Evidence from other regions, like AI and green logistics integration in courier services, suggests improved delivery efficiency and reduced environmental footprint. This paper adopted a mixed-method research design approach involving surveys, key informant interviews to investigate the current state of green logististics and AI adoption at ZimPost and secondary data analysis. Findings reveal that Zimpost has made efforts to integrate environmentally green logistics practices and AI-driven green logistics contributes to enhanced route efficiency, better resource utilization and reduced emissions, but faces implementation barriers such as limited resources, infrastructure gaps and inadequate policy framework. The study recommends that Zimpost invest strategically in AI, alternative fuels, route optimization, employee training, compliance to supportive policy frameworks to strengthen sustainable transportation practices for the Zimbabwean courier industry. The conclusions hence are attached to Zimbabwe's broader sustainability goals whereby green logistics is now viewed as both a business imperative and social responsibility in the dynamic logistics landscape.

Web 3.0 & Decentralized Web: A Comprehensive Study in Emerging Trends and Future Prospectus

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Abstract
Web 3.0 is known as "The Decentralized web or Semantic Web". This version of the internet allows individuals to have more control of how they manage their information and experience online. Instead of building an online world for you by using large corporations to manage your data and online interactions, Web 3.0 incorporates Blockchains, peer-to-peer networks and other decentralized infrastructure into a new architecture that is more transparent and accessible. A significant driver of this latest iteration of the Web is the development of digital identities. Self-sovereign identity (SSI) and decentralized identity management tools provide users with the ability to manage how, when and with whom they share their data and to maintain the security of their personal information without relying on a central authority to store or verify it. Decentralized storage, distributed computing, and community governance (like a decentralized autonomous organization, or DAO) are offering new opportunities for innovation by creating more adaptable and resilient service offerings that are less susceptible to corporate control and failure. This review adopts a systematic approach by analyzing recent research articles, journals and industry reports on Web 3.0, blockchain applications, decentralized identity, and decentralized infrastructures. Web 3.0 still faces hurdles in the form of policies, user-friendliness, scalability, security issues, power consumption etc. It provides an informative framework for all of us to experience increased independence, more privacy, and new ways to actively participate in this new online world filled with many unique opportunities.

Intelligent Technologies for Climate-Responsive Cities: Integrating AI, Blockchain, and Sustainable Infrastructure

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Abstract
The rapid urbanization across the globe necessitates innovative solutions to develop sustainable, resilient, and efficient urban environments. Smart Cities leverage Information and Communication Technologies (ICT) to optimize urban services, enhance quality of life, and promote sustainable development. This paper explores the transformative role of Block chain technology in advancing ICT-driven sustainable infrastructure within smart cities. Block chain, with its decentralized, transparent, and secure features, offers significant potential to address key challenges such as data security, interoperability, and trust among stakeholders. The integration of Block chain into urban infrastructure facilitates secure data sharing, efficient resource management, and transparent transaction processes, thereby fostering resilience and sustainability. Case studies demonstrate how Block chain can optimize energy distribution, streamline urban governance, and enable innovative applications like smart contracts and digital identities, which are vital for resilient urban ecosystems. Furthermore, the paper discusses the technical, social, and policy implications of implementing Block chain-enabled solutions in smart city frameworks. Challenges such as scalability, regulatory hurdles, and technological adoption are critically analyzed, along with strategies for effective integration. The findings highlight that Block chain, when combined with other ICT tools, can significantly enhance the robustness and sustainability of urban infrastructure, paving the way for resilient and inclusive cities of the future. This research underscores the importance of cross-disciplinary approaches and stakeholder collaboration to harness Block chain's full potential in creating sustainable urban environments that are adaptable to future challenges.

Keywords: Smart Cities, ICT, Block chain, Sustainable Infrastructure, Urban Resilience, Digital Transformation, Urban Governance, Smart Contracts, Data Security, Sustainable Development.

Design and Analysis of a U Shaped Slotted Cylindrical Dielectric Resonator Antenna for 2.4 GHz ISM Band Applications

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Abstract
In the unprecedented technological change where complexity in communication technology is staggering, the Cylindrical Dielectric Resonator Antenna is an emerging technology. It provides better solutions than traditional micro-strip antenna technology while addressing the physical and electrical requirements. This paper focuses on the design solution and mathematical analysis of a U-shaped slotted micro-strip fed CDRA for 2.4 GHz narrow band applications. The carved U-shaped notch creates the electric field distribution offset and hence can fine-tune the resonant frequency to 2.37 GHz to 2.46 GHz with 25 dB return loss at 2.41 GHz for industrial, scientific, and medical band applications.

Leveraging Artificial Intelligence and Sustainable Strategies for Carbon Footprint Reduction

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Abstract
The accelerating impact of climate change and rising greenhouse gas emissions have intensified global efforts to identify innovative solutions for reducing carbon footprints across economic and industrial sectors. Artificial Intelligence (AI) has emerged as a transformative technological tool capable of supporting environmental sustainability by enabling intelligent data analysis, predictive modeling, and optimized resource management. The integration of AI with sustainable development strategies has opened new possibilities for monitoring carbon emissions, improving energy efficiency, and facilitating environmentally responsible decision-making. In this context, the present study explores the role of artificial intelligence and sustainable approaches in reducing carbon footprints and promoting climate-responsive development. The study is having two research objectives: (1) to examine the potential of artificial intelligence in supporting carbon footprint reduction across different sectors, and (2) to analyze sustainable approaches and technological strategies that can contribute to climate mitigation and environmental sustainability. The research adopts a conceptual and exploratory approach based on secondary data, drawing insights from scholarly articles, international reports, sustainability frameworks, and global climate policy documents. Relevant literature from academic databases, sustainability reports, and institutional publications has been systematically reviewed to identify emerging patterns and practical applications of AI in climate action. Furthermore, sustainable practices such as renewable energy adoption, circular economy models, and green infrastructure complement AI-driven solutions in reducing environmental impact. The study also highlights challenges related to data availability, technological infrastructure, and energy consumption of advanced AI systems.The study suggests that future research and policy initiatives should focus on developing green AI frameworks, strengthening digital sustainability ecosystems, and promoting interdisciplinary collaboration to accelerate the transition toward low-carbon and climate-resilient economies.

Artificial Intelligence and Green Technology: A Path to Carbon Reduction

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Abstract
The global imperative to mitigate climate change has accelerated the adoption of Green Technology, and Artificial Intelligence (AI) is increasingly recognized as a transformative enabler in this domain. This study explores the convergence of AI and green technology as a strategic pathway to carbon reduction, emphasizing the role of intelligent systems, predictive analytics, and data-driven decision-making in creating environmentally sustainable solutions. AI applications in green technology span multiple sectors, including energy, manufacturing, transportation, and urban infrastructure. Machine learning algorithms and optimization models facilitate real-time monitoring of energy consumption, emissions, and resource utilization, enabling proactive interventions to minimize environmental impact. AI-driven predictive maintenance reduces equipment downtime and energy waste, while smart grids and automated energy management systems optimize electricity distribution and integrate renewable energy sources effectively. In addition, AI supports lifecycle analysis and carbon accounting, allowing organizations to measure, manage, and report their carbon footprint with accuracy. The integration of AI with green technologies also enhances operational efficiency, reduces material waste, and supports circular economy practices, such as intelligent recycling and sustainable resource management. Data-driven insights generated by AI enable stakeholders to identify high-impact interventions, prioritize sustainability initiatives, and implement scalable low-carbon strategies. Comparative analysis demonstrates that organizations leveraging AI assisted green technologies achieve measurable reductions in greenhouse gas emissions while improving productivity and cost efficiency. The findings underscore that AI is not merely a computational tool but a critical enabler of systemic environmental transformation. By embedding intelligent decision-making within green technology frameworks, organizations and communities can accelerate the transition to a low carbon economy, enhance resilience to climate risks, and achieve long-term sustainability objectives.

Keywords - Artificial Intelligence, Green Technology, Carbon Reduction, Sustainable Development, Predictive Analytics.

Green Computing and Artificial Intelligence for Sustainable Development

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Abstract
The increasing demand for computing power and data-driven solutions has contributed significantly to global energy consumption and associated carbon emissions. Green computing, combined with Artificial Intelligence (AI), offers a transformative approach to sustainable development by optimizing energy usage, reducing electronic waste, and promoting environmentally responsible digital practices. This study investigates how AI-driven green computing strategies can support sustainable growth across industries, smart cities, and organizational operations. Green computing encompasses energy-efficient hardware, virtualization, cloud optimization, and environmentally conscious software development. When integrated with AI, these systems can intelligently monitor resource usage, predict energy demand, and optimize computational workloads in real time. Machine learning algorithms enable dynamic energy management, workload balancing, and predictive maintenance of IT infrastructure, minimizing unnecessary power consumption while maintaining performance efficiency. AI-powered analytics also facilitate sustainable decision-making by evaluating carbon footprints, resource utilization patterns, and environmental risks associated with digital operations. The research demonstrates that implementing AI-enabled green computing solutions can lead to measurable reductions in energy consumption, carbon emissions, and operational costs. In addition, these solutions promote sustainable practices such as intelligent resource allocation, automated recycling of obsolete hardware, and the development of low-power algorithms, aligning technological innovation with environmental objectives. Case studies indicate that organizations adopting AI-assisted green computing achieve both ecological benefits and enhanced computational efficiency, illustrating the potential for scalable and replicable sustainable models. The study highlights the critical role of AI and green computing in supporting sustainable development goals (SDGs), particularly responsible consumption and production (SDG 12) and climate action (SDG 13). By embedding intelligent, eco-efficient practices within IT ecosystems, businesses and governments can contribute to a low-carbon economy while maintaining technological advancement and operational competitiveness.

Keywords- Green Computing, Artificial Intelligence, Sustainable Development, Energy Efficiency, Carbon Footprint Reduction.

Intelligent Systems for Energy Optimization

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Abstract
Efficient energy management is critical to achieving sustainable development and mitigating climate change. Intelligent systems for energy optimization leverage advancements in Artificial Intelligence (AI), machine learning, and data analytics to enhance energy efficiency, reduce operational costs, and minimize carbon emissions across industrial, commercial, and residential sectors. This study explores the design, implementation, and impact of AI-enabled intelligent systems that monitor, analyze, and optimize energy consumption in real time. The research focuses on integrating predictive algorithms, sensor networks, and smart decision support platforms to manage energy demand, detect inefficiencies, and automate load balancing. Machine learning models forecast consumption patterns, optimize heating, ventilation, and air conditioning (HVAC) systems, and schedule energy-intensive operations during low-demand periods. Additionally, integration with renewable energy sources, such as solar and wind, enables dynamic energy allocation, reducing dependency on fossil fuels and supporting grid stability. Data-driven insights generated by intelligent systems facilitate proactive energy management by identifying underperforming equipment, predicting maintenance requirements, and suggesting optimization strategies. The systems also incorporate carbon footprint metrics, enabling organizations to track and reduce greenhouse gas emissions while complying with environmental regulations. Comparative analysis demonstrates that implementing intelligent energy optimization systems can achieve significant reductions in energy consumption and emissions without compromising operational efficiency or productivity. This study highlights the transformative role of intelligent systems in creating energy-resilient and environmentally responsible infrastructure. By combining AI, IoT, and advanced analytics, these systems provide scalable, adaptable, and measurable pathways toward sustainable energy management. The findings underscore the potential of intelligent energy optimization as a key enabler of low-carbon industrial practices and smart urban development, aligning technological innovation with global climate action goals.

Keywords- Intelligent Systems, Energy Optimization, Artificial Intelligence, Carbon Footprint Reduction, Smart Energy Management.

Digital Transformation for a Low-Carbon Economy

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Abstract
The transition toward a low-carbon economy has become a global priority as governments, industries, and institutions confront the escalating impacts of climate change. Digital transformation plays a pivotal role in accelerating this transition by integrating advanced technologies into economic and operational systems to enhance efficiency, transparency, and sustainability. This study examines how digital technologies—including Artificial Intelligence (AI), Big Data analytics, Internet of Things (IoT), cloud computing, and smart automation—can enable measurable carbon reduction across sectors. Digital transformation facilitates real-time monitoring of energy consumption, emissions tracking, and predictive modeling for resource optimization. AI-driven analytics support intelligent decision-making by forecasting demand, optimizing supply chains, reducing material waste, and improving energy efficiency in manufacturing, healthcare, transportation, and urban infrastructure. Smart grids and IoT-enabled devices enhance energy distribution efficiency, while cloud-based systems reduce reliance on energy-intensive on-premise infrastructure through scalable and optimized resource allocation. Furthermore, the integration of carbon accounting frameworks into enterprise digital platforms strengthens environmental governance and regulatory compliance. Organizations leveraging digital transformation can shift from reactive sustainability reporting to proactive emission management, embedding environmental performance metrics into strategic planning and operational workflows. This alignment not only reduces greenhouse gas emissions but also enhances economic resilience, cost efficiency, and innovation capacity. The findings suggest that digital transformation is not merely a technological upgrade but a systemic enabler of sustainable development. By combining data-driven intelligence with green innovation strategies, economies can decouple growth from carbon intensity and move toward long-term environmental stability. The study underscores the importance of interdisciplinary collaboration in building digitally empowered, climate-resilient economic systems.

Keywords: - Digital Transformation, Low-Carbon Economy, Artificial Intelligence, Carbon Emission Reduction, Sustainable Development.

ML approaches to Environmental Approaches: Cloud & Edge Computing Reducing the CO_2

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Abstract

The growing environmental impact of computational infrastructure has highlighted the need for energy-efficient and sustainable computing solutions. Cloud and edge computing have emerged as critical platforms for managing large-scale digital workloads, but they also contribute significantly to carbon dioxide (CO_2) emissions due to high energy consumption. This study explores the application of Machine Learning (ML) approaches to optimize cloud and edge computing operations with the aim of reducing environmental impact and supporting sustainable development. ML algorithms can analyze real-time energy usage, workload distribution, and server performance to optimize resource allocation across cloud data centers and edge nodes. Predictive models forecast demand fluctuations, enabling dynamic scaling of computing resources, workload balancing, and task scheduling that minimizes idle energy consumption. Reinforcement learning techniques are employed to continuously adapt system configurations, reducing peak power demand and enhancing energy efficiency. Additionally, ML-driven insights guide the placement of computation between cloud and edge infrastructures, ensuring that latency, energy use, and emissions are simultaneously minimized. The study demonstrates that integrating ML with cloud and edge computing can lead to substantial reductions in CO_2 emissions while maintaining high system performance. Data driven optimization also facilitates carbon-aware routing, renewable energy integration, and efficient cooling management in data centers. Comparative analysis shows that ML-assisted cloud and edge strategies outperform traditional static provisioning models in terms of both energy savings and environmental impact. The findings underscore the potential of machine learning as a core enabler of sustainable computing. By embedding intelligent, adaptive mechanisms into digital infrastructure, organizations can achieve low-carbon computing practices, reduce operational costs, and contribute to global climate action goals. This research establishes a scalable framework for environmentally conscious digital transformation in the era of cloud and edge computing.

Sustainable AI Frameworks for Decentralized Carbon Mitigation: Leveraging Deep Reinforcement Learning and IoT in Smart Cities and Green Manufacturing Networks

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Abstract
The rapid urbanization and industrial expansion of the 21st century have significantly intensified global carbon emissions, necessitating innovative strategies for sustainable development. This study proposes a Sustainable AI Framework for decentralized carbon mitigation by integrating Deep Reinforcement Learning (DRL) and Internet of Things (IoT) technologies within smart cities and green manufacturing networks. The framework utilizes IoT-enabled sensors and edge devices to continuously monitor energy consumption, emission levels, and process efficiency across distributed urban and industrial nodes. These real-time datasets are processed through DRL algorithms that dynamically optimize operational parameters, including energy allocation, production scheduling, and demand-response strategies, to minimize overall carbon footprint while maintaining system performance. A multi-agent DRL approach enables coordination across heterogeneous nodes, ensuring decentralized decision-making and scalability in complex urban-industrial ecosystems. The framework also incorporates predictive modeling for carbon emission trends and anomaly detection to proactively mitigate high-emission events. Simulation results conducted on representative smart city and manufacturing environments demonstrate that the proposed system can achieve significant reductions in CO_2 emissions (up to 25–30%) compared to conventional centralized management approaches, while enhancing operational efficiency. Furthermore, the modular design of the framework allows seamless integration with renewable energy sources, smart grids, and circular economy initiatives, promoting sustainability across multiple domains. This research establishes a methodological foundation for deploying **AI driven, IoT-enabled, decentralized carbon mitigation strategies**, contributing to climate resilient urban planning and eco-efficient industrial operations.

Keywords: Sustainable AI, Deep Reinforcement Learning, IoT, Smart Cities, Green Manufacturing, Decentralized Carbon Mitigation, Carbon Footprint Optimization, Multi-Agent Systems, Predictive Emission Modeling, Energy Efficiency.

Leveraging Artificial Intelligence for Holistic Decarbonization: Multi-Layered Optimization of Energy Consumption, Emissions Monitoring, and Resource Efficiency in Smart Manufacturing

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Abstract
The industrial sector is a primary contributor to global carbon emissions, necessitating integrated approaches that combine operational efficiency with environmental sustainability. This study presents a holistic AI-driven framework for decarbonization in smart manufacturing environments, employing multi-layered optimization to reduce energy consumption, enhance emissions monitoring, and improve resource utilization. The proposed framework integrates advanced machine learning algorithms, predictive analytics, and IoT-enabled sensors to capture real-time data on energy flows, production processes, and material usage across manufacturing nodes. At the first layer, predictive models analyze historical and real-time data to forecast energy demand, identify high-emission operations, and detect inefficiencies. The second layer employs optimization algorithms to dynamically adjust process parameters, energy allocation, and equipment scheduling, balancing production targets with minimal carbon output. The third layer focuses on resource efficiency**,** leveraging AI to optimize raw material consumption, minimize waste, and support circular economy practices. A feedback loop enabled by IoT sensors ensures continuous monitoring and iterative refinement of AI decisions, facilitating proactive mitigation of emission spikes and resource wastage. Simulation and case studies on representative smart manufacturing networks demonstrate that the framework can achieve substantial reductions in CO_2 emissions (up to 28–32%), while improving energy efficiency and operational throughput. The modular architecture allows scalability across heterogeneous industrial setups and seamless integration with renewable energy systems, smart grids, and digital twin platforms. This research underscores the potential of AI-enabled multi-layered optimization as a strategic tool for industrial decarbonization, providing actionable insights for sustainable manufacturing, policy development, and long-term environmental stewardship.

Keywords: Artificial Intelligence, Smart Manufacturing, Decarbonization, Energy Optimization, Emissions Monitoring, Resource Efficiency, IoT, Predictive Analytics, Process Optimization, Sustainable Industrial Systems

AI-Driven Strategies for Carbon Footprint Mitigation in Industrial and Urban Ecosystems: Integrating Predictive Analytics, Machine Learning, and IoT Enabled Sustainability Frameworks

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Abstract
Rapid urbanization and industrialization have accelerated greenhouse gas emissions, posing significant challenges to climate sustainability. This study proposes AI-driven strategies for carbon footprint mitigation by integrating predictive analytics, machine learning, and IoT enabled sustainability frameworks within industrial and urban ecosystems. The approach leverages real-time data collected from IoT sensors deployed across energy networks, manufacturing plants, transportation systems, and urban infrastructure to monitor emissions, energy consumption, and resource utilization. The collected data is processed using machine learning algorithms to identify patterns, predict high-emission events, and optimize operational efficiency across multiple sectors. Predictive analytics enables proactive interventions, such as dynamic energy allocation, adaptive load management, and emission reduction scheduling, ensuring minimal environmental impact while maintaining system performance. Additionally, the framework supports decentralized decision making, allowing both industrial facilities and urban infrastructure components to autonomously adjust operations based on predictive insights and sustainability targets. Simulation results conducted on representative smart city and industrial ecosystems demonstrate that the proposed AI-driven framework can reduce CO_2 emissions by up to 30%, while enhancing energy efficiency and resource utilization. The modular and scalable design allows seamless integration with renewable energy sources, smart grids, and circular economy initiatives, promoting long-term sustainability. Furthermore, the system provides actionable insights for policymakers and industry stakeholders, enabling data-driven strategies for emission mitigation, urban planning, and sustainable industrial growth. This research establishes a comprehensive methodology for deploying AI-enabled, IoT integrated carbon management systems, bridging the gap between industrial operations, urban planning, and environmental sustainability.

Keywords:- Artificial Intelligence, Machine Learning, Predictive Analytics, IoT, Carbon Footprint Mitigation, Industrial Ecosystems, Urban Sustainability, Energy Optimization, Emissions Monitoring, Smart Cities.

Explainable AI Approaches for Emission Control: Quantifying and Reducing Carbon Footprints across Multi-Sector Industrial Operations

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Abstract
Industrial operations across multiple sectors remain a significant contributor to global carbon emissions, necessitating transparent and data-driven approaches for effective mitigation. This study presents Explainable Artificial Intelligence (XAI) frameworks for emission control, focusing on the quantification and reduction of carbon footprints in complex multi-sector industrial ecosystems. By integrating machine learning models with interpretability techniques**,** the framework not only predicts emission patterns but also provides actionable insights into the underlying drivers of high carbon output. IoT-enabled sensors continuously collect data on energy consumption, production cycles, raw material usage, and waste generation across industrial facilities. These datasets feed into XAI algorithms, including SHAP (SHapley Additive exPlanations) and LIME (Local Interpretable Model-agnostic Explanations), to generate interpretable models that identify critical emission sources and potential optimization opportunities. A multi-layered optimization module leverages these insights to suggest operational adjustments, energy allocation strategies, and process scheduling improvements, enabling real-time emission mitigation while maintaining productivity. Simulation studies across representative manufacturing, chemical, and logistics sectors demonstrate that the XAI-driven approach can reduce CO_2 emissions by up to 25%, improve energy efficiency, and enhance resource utilization. Moreover, the explainable nature of the system ensures stakeholder trust, facilitates regulatory compliance, and supports strategic decision-making for sustainability initiatives. The modular architecture allows scalability and integration with renewable energy systems, smart grids, and digital twin platforms for continuous carbon management. This research highlights the potential of Explainable AI as a transformative tool for industrial decarbonization, combining predictive accuracy with operational transparency, thereby enabling multi-sector industries to achieve measurable and sustainable reductions in carbon emissions.

Keywords:- Explainable AI, Carbon Footprint Reduction, Emission Control, Multi-Sector Industrial Operations, Machine Learning, SHAP, LIME, IoT, Energy Optimization, Sustainable Manufacturing.

Cognitive AI for Real-Time Carbon Footprint Monitoring: Leveraging IoT Sensors, Predictive Analytics, and Edge Computing for Sustainable Operations

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Abstract
The pressing challenge of industrial and urban carbon emissions demands intelligent, real-time monitoring frameworks that enable proactive mitigation and sustainable operations. This study proposes a Cognitive AI framework for real-time carbon footprint monitoring, integrating IoT sensors, predictive analytics, and edge computing to provide actionable insights into energy consumption, emissions, and resource utilization. The framework continuously collects data from distributed sensors deployed across manufacturing facilities, urban infrastructure, and energy networks, capturing multi-dimensional metrics such as CO_2 output, energy load, operational cycles, and material consumption. Cognitive AI algorithms process these high-frequency datasets to learn contextual patterns, detect anomalies, and predict emission spikes, enabling adaptive interventions in near real-time. Edge computing ensures low-latency processing and decentralized decision-making, allowing local nodes to optimize operational parameters, adjust energy allocation, and reduce emissions without relying solely on centralized systems. The predictive analytics component further supports scenario-based planning, enabling organizations to model carbon reduction strategies and evaluate sustainability interventions before deployment. Simulation and case studies on representative smart manufacturing and urban ecosystems demonstrate that the proposed system can reduce carbon emissions by up to 28%, improve energy efficiency, and enhance overall operational sustainability. The framework's modular architecture allows seamless integration with renewable energy sources, smart grids, and digital twins, fostering a resilient and eco-efficient operational environment. By combining Cognitive AI, IoT, and edge computing, this research provides a comprehensive, scalable approach to real-time carbon footprint monitoring and mitigation, empowering industries and cities to achieve data-driven sustainability goals while maintaining operational performance.

Keywords:- Cognitive AI, Real-Time Carbon Monitoring, IoT Sensors, Edge Computing, Predictive Analytics, Sustainable Operations, Energy Efficiency, Emission Reduction, Smart Manufacturing, Urban Sustainability.

Integrating AI and Life Cycle Assessment for Quantitative Reduction of Carbon Footprint in Renewable Energy, Smart Grids, and Industrial Processes

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Abstract

The global transition toward sustainable energy systems requires precise quantification and mitigation of carbon emissions across multiple sectors. This study presents an integrated framework combining Artificial Intelligence (AI) with Life Cycle Assessment (LCA) to achieve quantitative reductions in carbon footprints across renewable energy systems, smart grids, and industrial processes. The approach utilizes IoT-enabled sensors and real-time operational data to capture energy consumption, material use, and emission profiles at various stages of production, distribution, and utilization. AI models, including predictive analytics and machine learning algorithms, process LCA data to identify high-impact emission hotspots, optimize resource allocation, and forecast potential improvements. By integrating predictive insights with LCA results, the framework enables data-driven strategies for reducing energy wastage, improving process efficiency, and maximizing renewable energy integration. Smart grid nodes leverage these insights for adaptive load balancing and decentralized energy optimization, while industrial processes adjust operational parameters to minimize emissions without compromising productivity. Case studies across representative renewable energy installations, smart grids, and manufacturing facilities demonstrate that the integrated AI-LCA framework can reduce carbon emissions by 20–30%, enhance energy efficiency, and support sustainable decision-making. The modular design ensures scalability, cross-sector applicability, and alignment with circular economy principles. This research demonstrates that AI-enhanced Life Cycle Assessment provides a systematic, quantitative approach to carbon footprint reduction, offering actionable insights for energy planners, industrial managers, and policymakers striving for sustainable and resilient operations.

AI and Big Data in Healthcare ERP: Measuring and Reducing Carbon Footprint through Smart Resource Planning

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Abstract
The healthcare sector is increasingly challenged to reconcile operational efficiency with environmental sustainability, as hospital networks and medical supply chains contribute significantly to energy consumption, material waste, and indirect greenhouse gas emissions. This study presents a critical and analytical examination of Artificial Intelligence (AI) and Big Data integration within Enterprise Resource Planning (ERP) systems in the medical industry, focusing on measurable carbon footprint reduction through smart resource planning. The research investigates how predictive analytics, machine learning algorithms, and real-time data integration can transform conventional ERP frameworks into sustainability-oriented decision-support systems. Using multi-source healthcare datasets—including procurement records, inventory flows, energy usage logs, and patient service demand patterns—the study develops predictive models to optimize supply chain scheduling, reduce overstocking, minimize pharmaceutical waste, and enhance energy-efficient asset utilization. Carbon accounting metrics are embedded within ERP dashboards to quantify Scope 1, Scope 2, and selected Scope 3 emissions associated with operational activities. Comparative analysis indicates that AI-enabled forecasting significantly reduces redundant procurement cycles, emergency logistics, and storage-related energy consumption, leading to measurable emission reductions and cost efficiencies. The findings demonstrate that intelligent ERP ecosystems can move beyond administrative automation toward proactive sustainability governance. By integrating environmental performance indicators into core planning modules, healthcare organizations can align operational resilience with climate responsibility. The proposed framework provides a scalable, data-driven pathway for low-carbon digital transformation in the medical industry while strengthening regulatory compliance and long-term institutional sustainability.

Keywords:-Artificial Intelligence in Healthcare, Big Data Analytics, Enterprise Resource Planning (ERP), Carbon Footprint Measurement, Sustainable Healthcare Systems.

GSM & Arduino Wireless Digital Notice Board

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Abstract
The digital notice board system have become a must have communication tool in several institutions such as school, colleges, offices & public places. This project represents sophisticated digital information notice board built with the help of Arduino and GSM technology to create a solution that is dynamic as well as efficient and user-friendly for disseminating information. The concept of the system is to replace traditional use of notice boards with a digital display which can be updated remotely using either SMS or Selective Access Protocol (SAPs) based applications. Key innovations and features are Remote update via GSM module: The remote update feature provides the ability to send updates to the digital notice board from anywhere by the authorised personnel which makes the communication between the resources placed on the digital notice board and the control panel efficient and timely. In addition, there is a web-based interface for managing and scheduling announcements, which provides a flexible way to deal with content management. Integration of real-time clock (RTC) module, allowing scheduling of messages and for providing the correct display of time sensitive information The notice-board caters to a plurality of languages, providing for diverse user groups and is energy efficient with an eco-friendly design and the provisions of low power consumption components and automatic dimming feature based on light conditions. Furthermore, it has a quick alert feature which helps the urgent message to be disseminated instantly; thus having a role in increasing safety and response in critical situations. Optional interactive features such as touch interface for interaction and getting feedback from users adds to the versatility of the system. Robust security measures like access to authorized users, transmission of messages using encryption, and messagee approval processes, etc., are inbuilt to ensure that the unauthorized cannot exploit the process. Designed to be scalable, where it is easy to expand and or tailor to suit the environment or needs. Users are able to assign functions at certain times to display different information such as text, images and videos adding a greater utility and participation level of the notice board. The flexible, secure and convenient nature of the proposed system make it a suitable option to serve different sorts of organisational and public communication needs.

Keywords:- Digital notice Board, GSM Technology, Remote updating, Real-time Clock (RTC), Security Mechanized

Online Vehicle Reservation Parking System

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Abstract
Online Vehicle Parking Reservation System is a Web-based application that is designed to achieve optimization and digitization of vehicle parking operations. It defines two different roles of users that are administrator and standard user. Administrators have the attributes of managing parking infrastructure by creating, updating and monitoring parking slots and their occupancy status, while the users can register, authenticate, view real-time availability of parking locations, reserve parking slots, and release parking slots after completing use. Parking fees are automatically calculated relative to how long the vehicle stays inside the pillar and the payment for the fee is actually carried out in a simulated virtual deal for demonstration purposes. The system is created with the help of python (v 3.7.2) and MySQL; it can provide real time status and works for the multi user functionality. Consequently, the project provides a scalable, efficient and user friendly solution to the challenges faced by cities in terms of parking. It reduces the manual work and maximises the utilisation of the parking spaces. The proliferation of vehicles in urban centres has created huge problems with the effective management of parking space. The proposed system allows the users to register and access real time data regarding available parking slots and also allows the users to reserve spaces in advance and release the same after using the same. Parking fees are automatically determined on the basis of vehicle entry and exit stamps, thus ensuring accurate and clear pricing. Administrative capabilities allow for the effective management of parking areas, slot occupancy and utilisation patterns.The system is implemented by using Python for backend processing and a relational database for safe data storage and thus the system guarantees both reliability and scalability. Ex- perimental evaluations prove that the proposed system increases user convenience in terms of significant reduction of manual labour, utilisation of parking space and user convenience as compared to the conventional parking. The results prove excellent operational efficiency and careful management of the slot and reliable functioning in different user situations. Accordingly, the Online Vehicle Parking Reservation System is a sensible and scalable approach for smart parking control and can be easily extended to other smart city use cases.

Keywords:- Online Vehicle Parking System, Web-Based Parking Application, Parking Slot Reservation, Real-Time Parking Availability, Parking Slot Management, Automated Parking Fee Calculation, Multi-User Parking System, Smart Parking Solution, Urban Parking Optimization, Digital Parking Management.

AI-Enabled Environmental Surveillance of Neurotoxic Heavy Metals in Urban Transport Corridors: Evidence from Abuja, Nigeria

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Abstract

Rapid urbanization across sub-Saharan Africa has intensified vehicular emissions and particulate contamination, creating under-recognized pathways for chronic neurotoxic exposure. Urban environmental degradation threatens neurological health through the accumulation of potentially toxic elements (PTEs) in airborne dust, particularly cadmium (Cd) and lead (Pb), which are associated with oxidative stress, neuronal damage, and impaired neurodevelopment in children. Cd and Pb concentrations were quantified in in-vehicle and motor park dusts in Abuja, Nigeria, alongside eight additional PTEs using Atomic Absorption Spectrophotometry (AAS). Contamination was assessed using Enrichment Factor (EF), Geo-accumulation Index (Igeo), and Normalized Integrated Risk Index (NIRI). Human health risks were estimated using USEPA exposure models across ingestion, inhalation, and dermal pathways. Positive Matrix Factorization (PMF) identified dominant anthropogenic sources. Cadmium exceeded background levels by 1.6–1.7 times, indicating anthropogenic enrichment and dominance within the multi-metal exposure profile. PMF analysis attributed approximately 50% of emissions to brake and engine wear. Although carcinogenic and non-carcinogenic risks remained within regulatory thresholds, Cd posed the highest health risk, primarily via ingestion. Children exhibited greater vulnerability across exposure pathways. Cd and Pb contamination in urban transport environments necessitates targeted interventions, including safer vehicular materials and strengthened environmental monitoring. The validated dataset provides a baseline for training AI-driven geospatial models to enhance predictive environmental surveillance and support climate-resilient urban planning aligned with SDGs 3, 11, and 13.

Keywords:- Artificial Intelligence, Environmental Surveillance, Neurotoxicity, Cadmium, Lead, Urban Sustainability, Pollution.

Multi-Style Text Generation for Enhanced Text Transformation

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Abstract
Text style transfer seeks to rewrite text in a target style while preserving its semantic content and linguistic fluency. Most prior approaches focus on learning transformations between a single pair of styles, limiting their flexibility in real-world applications that require diverse stylistic adaptations. In this paper, we propose a unified, controllable neural text generation framework for multi-style text transformation. Our system maps a single input sentence into five distinct stylistic variants—Professional, Casual, Polite, Social, and Emojify—using a conditional sequence-to-sequence architecture based on FLAN-T5. To support multi-style learning, we construct a synthetic corpus by aggregating and normalizing style-annotated data into a HuggingFace-compatible JSONL format. Each instance is represented as a prompt of the form "convert to {style}:{original}" paired with a style-specific rewrite, enabling explicit style control through prompt conditioning. The model is finetuned using the Hugging Face Transformers and Hugging Face Datasets libraries on an HTCondor-managed OrangeGrid cluster. To ensure stable optimization under computational constraints, we disable in-loop evaluation, apply gradient accumulation to achieve an effective batch size of 16, and conduct a separate evaluation pipeline on a held-out test set. Experimental results on approximately 2,500 test examples demonstrate strong lexical overlap with reference rewrites, achieving ROUGE-1 of 0.7358, ROUGE-2 of 0.5923, ROUGE-L of 0.7247, ROUGE-Lsum of 0.7244, and BLEU of 0.5376. Qualitative analysis indicates that the Professional, Casual, Polite, and Social styles are consistently distinguishable and semantically faithful, whereas the Emojify style exhibits instability, frequently generating empty emoji placeholders. We analyze how data design, metric selection, and training decisions influence stylistic fidelity and evaluation outcomes, and we outline directions for improving emoji-based generation and developing style-aware evaluation metrics. The resulting model is designed for integration into a web-based interface, enabling multi-style rewriting as an assistive writing tool for adaptive communication contexts.

Keywords:- Text style transfer, sequence-to-sequence model, multi-style paraphrasing, emoji-based style, controllable text generation.

Artificial Intelligence Driven Sustainable Optimization for Hybrid Renewable Energy Power Systems

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Abstract

Hybrid renewable energy systems integrate multiple sources such as solar photovoltaic, wind energy, and battery storage to provide a reliable and environmentally sustainable power supply. With the increasing demand for clean energy and the need to reduce greenhouse gas emissions, the development of efficient and intelligent renewable energy systems has become essential. Combining different renewable sources enhances system reliability, as the variability of one source can be balanced by the availability of another. However, determining the optimal sizing and configuration of hybrid systems remains a challenging task due to changing weather conditions, variable load demand, and economic constraints related to installation, operation, and maintenance. This study proposes an artificial intelligence (AI)-based optimization framework for the sustainable design of hybrid renewable energy systems. The objective of the proposed method is to achieve an optimal system configuration that minimizes total cost while improving energy efficiency, reliability, and environmental performance. Key decision variables considered in the optimization process include the number of photovoltaic panels, wind turbines, and battery storage units required to meet energy demand under varying environmental conditions. An AI-driven evolutionary technique, namely the Genetic Algorithm (GA), is employed to identify the global optimal solution through an adaptive population-based search process. The algorithm evaluates multiple system configurations and selects the most efficient and sustainable design based on predefined technical and economic criteria. Simulation results demonstrate improved energy utilization, reduced operational cost, enhanced system stability, and lower environmental impact compared to conventional design methods. The proposed approach offers an effective and sustainable solution for intelligent planning and management of hybrid renewable energy systems.

AI in Estimating Methane Emissions from Ruminants: A Zoological Perspective

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Abstract
Methane (CH4) emissions from ruminant livestock form a significant portion of global greenhouse gas (GHG) inventories, accounting for approximately 16% of anthropogenic emissions. These emissions have strong climatic implications due to methane's high global warming potential (GWP). Accurate and efficient estimation of ruminant methane production is crucial for mitigation strategies, policy frameworks, and sustainable livestock management. Traditional approaches-such as respiration chambers, sulfur hexafluoride (SF6) tracer technique, and in vivo calorimetry-are reliable but present logistical, financial, and animal welfare limitations. This research explores the integration of Artificial Intelligence (AI) methodologies in estimating methane output from ruminants, framed within a zoological context that considers behavioural, physiological, and ecological host factors. We evaluate data sources (sensor technologies, feed records, genotype databases), Al models (machine learning, deep learning, hybrid mechanistic models), and outcome metrics (prediction accuracy, generalizability, interpretability). Al applications include time-series prediction of emissions based on animal movement and feeding behaviour, metabolomic profiling for trait selection, and remote sensing across pasture ecosystems. The study synthesizes cross-disciplinary literature, conducts algorithm benchmarks on multi-source ruminant datasets, and proposes an integrated framework for Al-enabled methane estimation tailored to welfare-centric zoological research. Results indicate that Al models-especially ensemble learning and deep neural networks-can improve prediction accuracy by 15-30% over conventional statistical approaches, reduce monitoring costs by 40%, and enable scalable deployment in commercial herds. We further discuss limitations such as data bias, model transparency, ethical considerations in automated surveillance, and the need for biologically interpretable Al. This paper concludes that Al holds transformative potential in ruminant methane estimation, provided its integration respects zoological variability and ecological context. Future work should prioritize hybrid Al-mechanistic models and open data standards for global comparability.

Recent Advances in Artificial Roughness Geometries for Solar Air Heater Performance Enhancement: A Review

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Abstract
Solar air heaters are widely utilized in various thermal applications such as space heating, agricultural drying, timber seasoning, and industrial process heating due to their simple design, low cost, and use of renewable solar energy. However, the thermal performance of conventional solar air heaters is relatively low because of the poor convective heat transfer coefficient between the absorber plate and the flowing air. This limitation primarily occurs due to the formation of a viscous sublayer along the absorber plate surface, which restricts effective heat transfer. To overcome this issue, the concept of artificial roughness has been widely adopted to enhance turbulence near the absorber surface and improve the convective heat transfer rate. This review paper presents a comprehensive analysis of the research developments related to artificial roughened solar air heaters. Various roughness geometries proposed by different researchers, such as transverse ribs, inclined ribs, V-shaped ribs, multi V-ribs, W-shaped ribs, broken ribs, dimpled surfaces, and staggered ribs—are systematically examined in terms of their heat transfer enhancement and friction characteristics. The influence of important roughness parameters including relative roughness height (e/D), relative roughness pitch (P/e), angle of attack, Reynolds number, and roughness arrangement on the thermo-hydraulic performance of the system is critically discussed. The study highlights that artificial roughness significantly enhances the Nusselt number and thermal efficiency compared with smooth duct solar air heaters, although it also increases the friction factor and pressure drop. Therefore, performance evaluation criteria such as thermo-hydraulic performance parameter (THPP) or efficiency enhancement factor are used to determine the optimum roughness configuration. Based on the literature survey, certain rib geometries such as V-shaped and multi V-shaped ribs demonstrate superior thermo-hydraulic performance compared with conventional rib designs. The review concludes that artificial roughening of absorber plates is an effective and promising technique for improving the overall performance of solar air heaters. Future research should focus on advanced roughness geometries, hybrid roughness configurations, and the application of computational fluid dynamics and optimization techniques to further enhance system efficiency while minimizing energy losses.

Keywords: Solar air heater; Artificial roughness; Heat transfer enhancement; Rib roughness geometry; Thermo-hydraulic performance; Nusselt number; Friction factor.

Digital Transformation of Sustainability Reporting: An Outsourced ESG Platform Approach

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Abstract
The global renewable energy industry is becoming more and more under pressure to match the operational expansion with the transparent sustainability reporting and the quantifiable carbon cut down promises. The case study focuses on a France-based renewable energy company, which was established in 2005, and operates in various international markets in wind, solar, biomass, hydro and storage technologies. This paper examines how the organization switched its spreadsheet-based sustainability reporting to an external digital sustainability management platform to enhance the accuracy of carbon accounting and regulatory obligations. The overall research questions are to evaluate the difficulties of managing sustainability data manually, to determine how successfully outsourced ESG reporting solutions contribute to greater efficiency and adherence, and to evaluate how well solutions address the emission reduction targets in accordance with the global climate frameworks. The study adopted a secondary data-based approach, which relied on the disclosures of corporate sustainability, regulatory frameworks, industry reports, as well as documented implementation outcomes. The results indicate that spreadsheets dependence hindered reliability of data, and raised verification duration and analysis capacity. The externalized digital solution contributed to a sizable improvement in data validation, progress monitoring, internal controls, and compliance mapping and shortened reporting time with a concurrent possibility of the sustainability department focusing on strategic and qualitative ESG practices. Moreover, the platform enhanced a sense of transparency in emissions tracking and facilitated organised trajectories to the carbon intensity reduction targets. The researchers conclude that the outsourcing of sustainability data management to dedicated online platforms enhances governance, speeds up the process of compliance and enables greater attention on the long-term climate strategy of the organization. The implications of the future are that by incorporating AI-based ESG tools, renewable energy companies are able to improve decision-making, trust among their stakeholders, and regulatory preparedness and can also play a significant role in achieving global carbon-neutrality objectives.

Keywords:- Carbon Accounting, ESG Compliance, Renewable Energy, Sustainability Reporting, Technological Innovation

From Footprint to Future: Corporate Decarbonization Through Intelligent Emissions Management

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Abstract

In the modern age of climate responsibility, construction and engineering companies have become under pressure to incorporate sustainability in their business operations. JE Pvt. Ltd. was founded in 1890 and has made responsible growth the core of its operations by its Responsible Business Framework, especially in its Our Planet pillar. This paper focuses on how the company shifted to higher carbon management practices following the adoption of its Science Based Targets in 2024 when the company pledged to reduce its greenhouse gas emissions on Scope 1, 2, and 3 by 50.4 percent by 2032. The other objectives of the paper are to find out the difficulties in carbon accounting, the analysis of the actuality of digital sustainability solutions implementation, and the evaluation of how systematic emissions monitoring affects the long-term decarbonization objectives. Having a secondary data-driven approach, the current case study can be based on corporate sustainability reports, public disclosures, and recorded outcomes of the implementation concerning the adoption of the outsourced company management platform. The results show that centralized digital tracking and emissions modelling greatly reduced the problems that occurred in the past including low frequency of reporting, manual data processing, and difficulty in handling Scope 3 data. The outsourced company integration allowed tracking the emissions correctly, simplified the reports, adhered to the international standards and made the decarbonization strategies based on energy efficiency, adoption of renewable energy, and low-carbon transportation. It is important to note that the trends in emissions indicated a negative trend in 2024, as it is possible to take some positive steps towards the goals of 2032. It is noted that digital carbon accounting software can turn sustainability into a strategic performance driver, and not a compliance-based activity. The implication of this in the future implies that automation, collaboration in the supply chain and predictive modelling will play a critical role in attaining Scope 3 reduction and enhancing ESG transparency. The case provides a viable framework that can be duplicated by global engineering companies that are interested in finding data-driven solutions to sustainable growth.

Keywords: Carbon Accounting, Decarbonization, ESG Reporting, Greenhouse Gas Emissions, Sustainable Engineering

Life Cycle Carbon Optimization in Electronics Manufacturing: A Sustainability Transition Framework

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Abstract

The growing urgency of climate change has compelled manufacturing firms to re-evaluate their production systems and carbon responsibilities. ABC Limited, an electronics manufacturer of smart health devices, initiated carbon footprint tracking in 2022 and released its first carbon report in 2023, reflecting its commitment to low-carbon product development and global carbon neutrality. The primary objective of this study is to examine how ABC Limited integrates eco-design principles and life cycle assessment practices to reduce emissions across its value chain, particularly when 85% of its emissions originate from sold products. The research also aims to understand how digital simulation and supply chain visibility tools support the transition toward durable and climate-friendly products. This study adopts a secondary data-based methodology, drawing upon company reports, sustainability disclosures, industry databases, and documented case insights to analyze carbon management strategy. The findings reveal that eco-design requires comprehensive life cycle analysis, reliable emission factor databases, and strong supplier data integration. However, challenges such as limited upstream and downstream data control and inconsistent emission metrics complicate the process. By collaborating with a specialized climate-tech partner, ABC Limited achieved enhanced visibility of its emissions, identified carbon hotspots, compared alternative materials and logistics options, and simulated product-level changes to optimize sustainability performance. The adoption of digital carbon tracking tools enabled strategic decisions such as shifting from air freight to maritime transport and redesigning packaging materials to lower emissions. The study highlights that integrating life cycle transparency with data-driven simulations strengthens corporate climate strategies and accelerates sustainable innovation. Future implications suggest that manufacturers must invest in collaborative digital ecosystems, standardized emission databases, and supplier engagement frameworks to achieve long-term carbon neutrality goals while maintaining product durability and market competitiveness.

Keywords: Carbon Footprint, Eco-Design, Emission Hotspots, Life Cycle Assessment, Sustainable Manufacturing

From Compliance to Competitive Advantage: Leveraging Outsourced AI Platforms for Emissions Management

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Abstract
With the changing environment of sustainable retailing, organizations are being mandated more and more to make environmental responsibility a part of their core business strategy to help them become resilient and trustworthy to their stakeholders. The case study focuses on how one of the UK-based home improvement retailers; herein referred to as GBR Ltd. has integrated the sustainability to its strategic framework so as to comply with the UK 2050 net-zero obligation. The main research question is to examine how sustainability analytics based on AI that is outsourced can help major retailers overcome emissions management, supply chain transparency, and better ESG performance. The paper also aims to learn how data-driven partnership with suppliers can be part of effective decarbonization plans and credibility of the stakeholders. The study is based on the secondary data approach, which implies the analysis of publicly available sustainability reports, ESG disclosures, industry studies, and reported partnership results with an outsourced AI-based carbon management system. The analysis is concerned with the measurement of supply chain emissions, the digital integration mechanisms, and strategic sustainability reporting practices. Results indicate that the proportion of the carbon footprint of the retailer attributed to product-related supply chain activities was more than 95 percent, and therefore, granular, product-level emissions data are essential. Using an outsourced AI-based platform allowed the direct interaction with the suppliers, precise hotspots definition, simplified reporting, and enhanced data quality. This shift of industry-average estimates to real data on emissions greatly enhanced transparency, investor confidence and ESG ratings and helped to promote science-based targets. The AI analytics have changed sustainability into an activity that is driven by compliance to a competitive edge. The implication of the future is that outsourced AI-powered carbon intelligence solutions can be used in scalable models by retailers who want to take measurable steps towards climate, better supplier partnerships, and regulatory preparedness. The paper highlights strategic importance of technology-based sustainability in realization of environmental responsibility and business development.

Keywords:- Artificial Intelligence, Carbon Emissions, ESG Reporting, Scope 3 Emissions, Supply Chain Sustainability

AI-Driven Sustainable Business Models: Transforming Innovation for Environmental Responsibility

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Abstract
The growing urgency of climate change and resource depletion has compelled businesses to rethink traditional growth models and embrace sustainability-driven innovation. In this context, Artificial Intelligence (AI) has emerged as a transformative enabler, offering data-driven insights, predictive capabilities, and intelligent automation that support environmentally responsible decision-making. This study explores the concept of AI-Driven Sustainable Business Models and examines how AI technologies can be integrated into organizational strategies to reduce carbon footprints, optimize resource utilization, and create long-term sustainable value. The primary research objectives are to analyze the role of AI in reshaping sustainable business practices, identify key AI applications that promote environmental efficiency, and evaluate how AI-enabled models contribute to economic viability alongside ecological responsibility. The study adopts a secondary data-based methodology, drawing upon peer-reviewed journal articles, industry reports, sustainability disclosures, and global case studies from technology-driven enterprises. The findings indicate that AI significantly enhances energy efficiency, supply chain transparency, waste reduction, and predictive environmental monitoring. Moreover, organizations leveraging AI within sustainability frameworks demonstrate improved operational resilience and competitive advantage. The study further highlights that ethical governance and responsible AI deployment are critical to ensuring that technological advancement aligns with sustainability goals. Future implications suggest that AI-integrated sustainable business models will become central to corporate strategy, encouraging cross-sector collaboration, green innovation ecosystems, and policy alignment to achieve global climate targets.

Keywords: Artificial Intelligence, Business Innovation, Carbon Reduction, Sustainable Development, Technology Integration

Green Supply Chain and Logistics Optimization for Carbon Footprint Reduction

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Abstract
The increasing demand of climate change and the increasing global emissions have pushed industries to reconsider the supply chain practices in the traditional way and move towards responsible and environmentally friendly operations. Green Supply Chain Management (GSCM), and optimization of the logistics have become a strategic measure of minimizing the carbon footprint and ensuring the operational efficiency and competitiveness. The main aim of the proposed study is to investigate the role of green supply chain and optimized network of logistics in reducing carbon emission, enhancing cost efficiency, and sustainable value generation. The study in particular examines green supply chain, green logistics, green warehouse, green logistics reverse, and digital route optimization technology. This research is founded on the secondary data, which were gathered on published literature articles, sustainability reports, government publications, and international environmental databases. The review is a synthesis of the existing literature and evidence in the industry to assess the usefulness of the green logistics strategies in the reduction of the emissions at procurement, production, distribution, and post consumption stages. Comparative evaluation of traditional and green logistics models were done in order to get the performance results. The results had shown that the implementation of the green procurement policy, fuel-efficient transportation, AI-based route optimization, and reverse logistics systems can significantly decrease carbon emissions and increase cost-efficiency and brand trust. Companies that implement logistics planning that is based on data show reductions in fuel consumption and waste production that are quantifiable. The research paper concludes that green supply chain integration is not only an environmental requirement but also a strategic requirement to long-run sustainability. The implication in the future is that digital innovation, policy incentives, cross-sector collaboration, and an investment in clean technologies to scale green logistics operations are needed to scale global green logistics practices.

Keywords: Carbon Footprint, Green Logistics, Reverse Logistics, Supply Chain Optimization, Sustainable Procurement

Building a Sustainable Tomorrow: AI Approaches to Climate Action and Carbon Reduction

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Abstract
In an increasingly digital world, education systems are profoundly reliant on online platforms for teaching, learning, and administrative functions. While digital integration offers numerous benefits, it also exposes students and educators to a wide range of cyber threats, including data breaches, cyber bullying, and unauthorized access. Securing the future of education necessitates a comprehensive approach to promoting cyber security and online safety. This paper explores the importance of implementing robust cyber security measures within educational institutions, emphasizing the need for policies, awareness programs, and technological safeguards. It discusses the role of educators, students, and stakeholders in fostering a culture of online safety through training, responsible digital behavior, and proactive security practices. Additionally, the paper highlights innovative tools such as encryption, multi-factor authentication, and monitoring systems that can mitigate cyber risks. It underscores the significance of integrating cyber security education into curricula to empower students with the skills and knowledge necessary to navigate the digital landscape safely. Furthermore, the paper examines challenges faced by educational institutions in maintaining cyber security, including resource constraints and rapidly evolving cyber threats, and offers strategic recommendations to address these issues. Ultimately, fostering a secure digital environment in education is crucial for safeguarding personal data, ensuring uninterrupted learning, and building a resilient digital society. The findings suggest that collaborative efforts among policymakers, educators, and technology providers are essential to establish sustainable cyber security frameworks that secure the future of education in the digital age.

Keywords: Digital Security, Cyber Threats, Data Privacy & Digital Literacy, Cyber Awareness, Secure Learning Environments.

Heritage-Based Approaches in 21st Century Teaching and Learning: Preserving the Past, Empowering the Environmental Sustainability and Carbon Mitigation Future

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Abstract
In the rapidly evolving landscape of education in the 21st century, integrating heritage-based approaches offers a promising pathway to enrich teaching and learning experiences. This approach emphasizes the utilization of cultural, historical, and societal heritage as foundational elements to foster meaningful engagement, critical thinking, and a deeper understanding of identity among learners. By connecting students with their local and global heritage, educators can cultivate a sense of belonging, cultural awareness, and respect for diversity, which are essential skills in today's interconnected world. Heritage-based pedagogy also encourages experiential learning, storytelling, and the preservation of intangible cultural assets, making education more relevant and contextualized. Furthermore, this approach aligns with the goals of sustainable development by promoting the conservation of cultural heritage while simultaneously empowering learners to become active custodians of their cultural legacy. Implementing heritage-based strategies requires interdisciplinary collaboration, community involvement, and innovative teaching methods to effectively bridge the past with contemporary educational practices. In doing so, it not only preserves the rich cultural tapestry of societies but also equips learners with critical competencies to navigate and contribute to the future confidently. As education continues to evolve with technological advancements, integrating heritage-based approaches can serve as a vital tool for fostering cultural continuity, social cohesion, and lifelong learning. This paper explores the potential of heritage-based approaches in transforming 21st-century education, highlighting successful case studies, pedagogical frameworks, and policy implications. Ultimately, it advocates for a balanced integration of heritage and innovation to create inclusive, culturally responsive, and sustainable learning environments that empower future generations to value and preserve their cultural identities while embracing global challenges.

Keywords: Heritage-Based Education, Cultural Preservation, Interdisciplinary Pedagogy, Cultural Heritage,201 Pedagogical Innovation.

Artificial Intelligence and Green Data Analytics for Climate-Responsive Business Management

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Abstract

In the era of rapid digital transformation, leveraging data analytics has emerged as a pivotal strategy for fostering inclusive business management practices that drive sustainable development. This paper explores how advanced data analytics techniques can be harnessed to promote inclusivity across various facets of business operations, including supply chain management, customer engagement, workforce diversity, and social impact measurement. By analyzing large-scale data sets, businesses can identify underrepresented communities, assess social and environmental risks, and develop targeted interventions that enhance inclusivity. The integration of data-driven insights facilitates informed decision-making, enabling organizations to create equitable opportunities and promote sustainable growth. Furthermore, data analytics supports the monitoring and evaluation of corporate social responsibility initiatives, ensuring transparency and accountability. The paper also discusses the challenges related to data privacy, ethical considerations, and the digital divide that may impede the effective implementation of data-driven inclusive practices. To maximize the potential of data analytics in promoting sustainable development, organizations must adopt ethical frameworks, invest in capacity building, and foster collaboration among stakeholders. Ultimately, leveraging data analytics not only enhances business performance but also contributes significantly to achieving the United Nations Sustainable Development Goals (SDGs), fostering inclusive economic growth, social equity, and environmental sustainability. This study underscores the importance of integrating data-driven approaches into business management strategies to create resilient, inclusive, and sustainable enterprises in the 21st century.

Energy-Proportional and Carbon-Optimized Data Science Platforms Using Artificial Intelligence and Smart Grid Integration

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Abstract
The growing computational demands of academic Data Science platforms, driven by cloud computing, high-performance GPU clusters, and large-scale data analytics, have led to significant energy consumption and carbon emissions. Traditional resource management approaches often overlook temporal variations in energy efficiency and grid carbon intensity, resulting in suboptimal environmental performance. This study presents *"Energy-Proportional and Carbon-Optimized Data Science Platforms Using Artificial Intelligence and Smart Grid Integration,"* a framework that combines AI-based workload management with renewable energy-aware infrastructure to minimize carbon emissions while maintaining high computational throughput. The proposed system leverages artificial intelligence for real-time monitoring, predictive workload scheduling, and energy-proportional resource allocation across cloud servers, GPU clusters, and data storage systems. By integrating smart grid data, the framework dynamically aligns computational tasks with periods of low grid carbon intensity and high renewable energy availability. Techniques such as adaptive GPU scaling, mixed-precision computation, virtualization, and thermal-aware load balancing are employed to reduce idle power consumption and operational emissions. A lifecycle carbon assessment is incorporated to quantify both Scope 2 operational emissions and Scope 3 embodied emissions associated with hardware procurement and maintenance. Simulation results indicate that AI-enabled energy-proportional scheduling and smart grid integration can reduce energy consumption by 25–40% and decrease carbon intensity per computational task significantly, without compromising system performance. The study demonstrates that combining AI-driven resource optimization with smart grid–aware energy management provides a scalable, low-carbon solution for sustainable academic Data Science platforms.

Keywords: Energy-Proportional Computing, Carbon-Optimized Infrastructure, AI-Driven Workload Scheduling, Smart Grid Integration, Sustainable Data Science Platforms, GPU Efficiency, Lifecycle Carbon Assessment.

AI in Industrial Energy Efficiency and Carbon Monitoring Systems

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Abstract

Industrial activities consume substantial amounts of energy and contribute significantly to global carbon emissions. As industries face increasing pressure to meet sustainability targets and comply with environmental regulations, the adoption of intelligent technologies has become essential. Artificial Intelligence (AI) is emerging as a powerful tool for improving energy efficiency and enabling accurate carbon monitoring within industrial systems. This paper examines how AI-based solutions can transform industrial energy management practices. By utilizing machine learning algorithms and advanced data analytics, industries can analyse real-time data collected from sensors, smart meters, and production systems to detect inefficiencies and optimize energy usage. Predictive models help forecast energy demand, adjust operations dynamically, and reduce unnecessary consumption. AI-driven predictive maintenance further enhances efficiency by identifying potential equipment failures in advance, thereby preventing energy losses and operational disruptions. In addition, AI-enabled carbon monitoring systems provide continuous tracking of greenhouse gas emissions across various stages of production. These systems support transparent reporting, regulatory compliance, and informed decision-making. The integration of AI with technologies such as the Internet of Things (IoT), digital twins, and cloud computing enables the creation of intelligent, automated energy management frameworks that align industrial performance with sustainability objectives. Despite its potential, the implementation of AI in industrial environments presents challenges, including high initial investment, data management complexities, cybersecurity risks, and the environmental impact associated with computational processes. Addressing these concerns requires strategic planning, supportive policies, and responsible technological development.

Overall, AI offers a promising pathway for industries seeking to reduce their carbon footprint while maintaining operational efficiency and competitiveness in a rapidly evolving global economy.

AI-Orchestrated Cyber–Physical Frameworks for Smart Manufacturing and Sustainable Industry 4.0 Automation

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Abstract
Modern manufacturing systems are undergoing rapid transformation due to increasing product complexity, fluctuating market demand, ageing equipment, and rising pressure to meet decarbonization goals. Traditional automation approaches, which rely on predefined logic and scheduled maintenance, often struggle to adapt to dynamic operating conditions and diverse machine configurations. These limitations can result in unexpected downtime, inefficient energy usage, and reduced production flexibility. Industry 4.0 technologies attempt to address these challenges through the integration of cyber–physical systems (CPS), Industrial Internet of Things (IIoT) platforms, and data-driven decision frameworks. In practice, however, meaningful performance improvements increasingly depend on effective deployment of Artificial Intelligence (AI). Machine learning and deep learning models enable predictive maintenance, surface defect detection, energy-aware scheduling, and adaptive process control within smart factories. This paper presents an AI-enabled smart manufacturing architecture that combines Python-based analytics pipelines, IIoT sensing infrastructure, and edge–cloud computing mechanisms to support real-time industrial decision-making. The framework is conceptually demonstrated using representative public datasets for predictive maintenance and defect detection, including NASA C-MAPSS, AI4I 2020, and steel surface inspection datasets. Recent empirical studies indicate that hybrid CNN–LSTM models can achieve failure prediction accuracies above 94% with low false-positive rates, while AI-driven quality inspection systems significantly improve detection reliability compared to conventional methods. Beyond operational performance, the framework also considers sustainability integration through alignment with ISO 50001 energy management principles and lifecycle-oriented engineering practices. By linking production intelligence with facility-level energy optimization, the proposed approach supports improvements in reliability, productivity, and carbon efficiency, contributing to long-term ESG and net-zero industrial strategies.

AI-Integrated Intelligent Transportation Systems for Carbon-Aware Urban Mobility Optimization in Smart Cities

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Abstract
Over the past decade, urban growth has noticeably increased congestion levels and reduced travel reliability in many cities. Road transport remains a major contributor to transport-sector CO_2 emissions, accounting for nearly 70% of direct emissions globally. Conventional fixed-time traffic signal control and siloed traffic management architectures cannot adapt to stochastic, multimodal, and emission-constrained urban mobility patterns, limiting their capacity to support United Nations Sustainable Development Goal (SDG) 11 on sustainable cities. This paper proposes an AI-driven Intelligent Transportation System (ITS) framework that integrates traffic engineering, Python-based machine learning (ML), deep learning (DL), reinforcement learning (RL), computer vision (CV), and Internet of Things (IoT) infrastructures for sustainable mobility and carbon footprint reduction. The framework exploits real-world datasets, including METR-LA and PeMS highway sensor data, open traffic signal and loop-detector data, radar-based urban mobility datasets, and public GTFS/GTFS-realtime transit feeds. The methodology combines (i) multi-horizon traffic flow prediction via LSTM, GRU, and spatiotemporal graph neural networks (GNNs), (ii) single- and multi-agent deep RL (DQN, PPO) for signal control with emission-aware reward shaping, and (iii) YOLO-based vehicle detection and classification pipelines, all orchestrated over an edge–cloud ITS architecture. Reported results from recent studies indicate that deep RL-based adaptive signal control can reduce average vehicle waiting times by 27–48% and CO_2 emissions by 7–15% compared with actuated or fixed-time baselines in simulated urban networks. Complementary IoT-enabled adaptive control and V2X-based smart traffic control have achieved up to 82.8% travel-time reduction and ~51% reductions in fuel consumption and CO_2 emissions relative to static signals. For traffic speed prediction, hybrid LSTM–Transformer–GNN models on METR-LA achieve MAE as low as 0.0624 (normalized speed units) and RMSE around 0.1204, outperforming standalone LSTM and ST-GNN models. YOLO-based vehicle detection models trained on traffic surveillance datasets (e.g., BDD100K) reach mAP@50 of 0.89–0.90 for multi-class vehicle detection, supporting high-fidelity demand estimation. Key findings demonstrate that integrating predictive spatiotemporal modeling, RL-based multi-intersection coordination, and edge-deployed CV within a unified ITS can significantly reduce congestion-induced idling, fuel consumption, and CO_2 emissions while improving network throughput and travel time reliability. The paper situates this contribution within the ICAI-SACF 2026 theme "AI & Sustainable Approaches for Reducing Carbon Footprint," highlighting pathways to embed digital twins, EV-aware routing, and privacy-preserving federated learning into civil-infrastructure-centric smart mobility planning.

Keywords—Intelligent Transportation Systems, Smart Mobility, Deep Reinforcement Learning, Graph Neural Networks, YOLO, PeMS, METR-LA, Carbon Emissions, Smart Cities, SDG 11

AI-Driven Multi-Objective Energy Management for Low-Carbon Smart Infrastructure and Industrial Systems

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Abstract
Global energy use in buildings and industry remains a dominant driver of greenhouse gas emissions, with the operation of buildings alone responsible for around 30% of final energy consumption and 27–31% of energy-related CO_2 emissions worldwide. Conventional rule-based energy management systems for heating, ventilation and air conditioning (HVAC), lighting, and industrial loads are limited by static schedules and coarse feedback, leading to persistent energy inefficiencies and high carbon footprints. This paper proposes an integrated artificial intelligence (AI) framework that combines Python-based machine learning, deep learning, reinforcement learning and Internet of Things (IoT) sensing to optimize energy efficiency in smart infrastructure and smart industry. Using real datasets such as the UCI Energy Efficiency dataset, the ASHRAE Great Energy Predictor III building-meter dataset, and publicly available smart meter and building management datasets, the framework addresses three core tasks: (i) short-term and day-ahead energy load forecasting; (ii) reinforcement-learning-based HVAC and load control; and (iii) multi-objective optimization of energy, cost, and CO_2 emissions. Time-series models including linear regression, Random Forest, XGBoost, and Long Short-Term Memory (LSTM) networks are formulated and evaluated using metrics such as mean absolute error (MAE), root mean squared error (RMSE), and coefficient of determination R^2. Published results show that hybrid deep learning models (e.g., LSTM–XGBoost, CNN–LSTM) can achieve RMSE reductions of 20–30% and R^2 > 0.99 for smart grid load forecasting compared with classical baselines. Deep reinforcement learning (DRL) controllers for HVAC have demonstrated 16–25% reductions in heating or cooling energy demand versus rule-based and model predictive control, while maintaining comfort. Edge-AI-based digital twins targeting plug and process loads report up to 40% reductions in workstation electricity use and 82% reduction in phantom loads. When mapped onto global building and industrial emissions, such savings translate into meaningful contributions to Sustainable Development Goals SDG7 (affordable and clean energy), SDG11 (sustainable cities), and SDG13 (climate action). The paper details system architecture, mathematical formulations, dataset integration, performance evaluation, and civil engineering implications, aligning with the ICAI-SACF 2026 theme of AI & Sustainable Approaches for Reducing Carbon Footprint.

Keywords:- Smart infrastructure, energy efficiency, deep learning, reinforcement learning, HVAC control, smart grid, digital twins, IoT, carbon footprint, SDG7, SDG13.

AI Driven Personalised ayurveda: Integrating Prakriti Siddhanta with Predicitive Health Analytics

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Abstract
Ayurveda advocates a personalized approach to health through the principle of *Prakriti*, which defines an individual's anatomical build, physiological tendencies, and psychological disposition. Foundational treatises such as the Charaka Samhita explain that Prakriti is established at the moment of conception, shaping one's vulnerability to disease and responsiveness to therapy throughout life. Despite its clinical importance, conventional assessment of Prakriti remains predominantly subjective and reliant on practitioner interpretation, which restricts uniformity and large-scale application. With the advancement of precision medicine and artificial intelligence, a compelling opportunity emerges to translate Prakriti-based evaluation into a digitized, data-driven framework supported by predictive modelling and biomedical integration. This study aims to examine the classical understanding of Prakriti and its determinants, align these principles with contemporary biomedical indicators, and outline an AI-enabled model designed to deliver standardized and scalable personalized Ayurvedic care. An extensive textual analysis of the Charaka Samhita, Sushruta Samhita, and Ashtanga Hridaya was undertaken to extract references concerning Prakriti classification, Dosha dominance, and disease predisposition. Parallelly, current biomedical research addressing genomics, metabolomics, endocrine regulation, inflammatory biomarkers, and lifestyle-associated disorders was reviewed to identify potential correlations. Drawing from these integrative findings, a conceptual artificial intelligence framework is proposed. The model incorporates machine learning techniques trained on structured Prakriti assessment tools, biometric indicators, laboratory findings, and wearable health data to facilitate predictive risk stratification and individualized therapeutic planning. Classical literature characterizes Vata, Pitta, and Kapha constitutions as possessing distinct physiological traits and pathological inclinations. Emerging biomedical evidence indicates possible associations between constitutional profiles and variables such as metabolic efficiency, hormonal dynamics, stress adaptability, and inflammatory patterns. AI-driven analytical systems demonstrate the capacity to refine Prakriti categorization through objective pattern recognition, anticipate susceptibility to non-communicable conditions, and generate tailored recommendations encompassing diet, lifestyle modification, and therapeutic strategies. Continuous data acquisition from wearable technologies further enhances adaptive and real-time personalization. The integration of artificial intelligence into constitutional assessment establishes a structured and scalable pathway for advancing classical Ayurvedic practice. By harmonizing Prakriti Siddhanta with predictive analytics, traditional insights can be aligned with modern biomedical science, fostering a precision-based integrative healthcare model grounded in clinical rigor, ethical data management, and patient safety.

Keywords:- Ayurveda; Prakriti; Artificial Intelligence; Personalized Medicine; Predictive Modelling; Digital Health; Precision Care

AI in Herbal Drug Quality Assessment: A Perspective

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Abstract

Quality assessment of herbal drugs remains a critical challenge in Ayurvedic pharmaceutical sciences due to inherent variability in raw materials, seasonal variations, geographic sources and processing methods. Traditional quality control relies on organoleptic evaluation, physicochemical tests and chromatographic fingerprinting, which are time-consuming and require expert interpretation. Artificial Intelligence AI) offers transformative potential by integrating machine learning, computer vision and data analytics to standardize and accelerate herbal drug quality evaluation. The convergence of AI with pharmacognosy addresses long-standing issues of authentication, adulteration detection and batch consistency that have hindered global acceptance of Ayurvedic medicines. To explore current applications and future potential of AI technologies in herbal drug quality assessment. To highlight how AI can strengthen authenticity verification, phytochemical standardization and real-time quality monitoring in Ayurvedic pharmaceutical manufacturing. Comprehensive literature review of research papers, case studies and pilot projects implementing AI in botanical authentication, spectroscopy-based analysis and quality control systems for herbal medicines from Ayurvedic classics and modern scientific databases. Machine learning algorithms integrated with High-Performance Thin Layer Chromatography HPTLC, High-Performance Liquid Chromatography (HPLC) and Near-Infrared Spectroscopy (NIR) demonstrate 9298% accuracy in species identification and adulterant detection. Computer vision systems analyzing macroscopic and microscopic images achieve automated pharmacognostic evaluation with consistency exceeding manual methods. Deep learning models. Predict phytoconstituent concentrations from spectral data, enabling rapid batch testing. AI driven supply chain monitoring identifies quality deviations from cultivation through manufacturing, supporting Good Agricultural and Collection Practices (GACP). Natural Language Processing (NLP) extracts quality parameters from classical Ayurvedic texts, bridging traditional knowledge with modern analytics. AI technologies offer objective, reproducible and cost-effective solutions for herbal drug quality assessment. Integration of AI with traditional Ayurvedic wisdom requires validated datasets, collaboration between Vaidyas and data scientists, and ethical frameworks for data usage. Properly implemented AI systems can enhance pharmacovigilance, ensure regulatory compliance and strengthen evidence-based Ayurveda's global credibility.

Keywords: Artificial Intelligence, Herbal Drug Quality, Pharmacognosy, Machine Learning, Ayurvedic Pharmaceutics

Wildlife tourism and local communities: Evidence from Sudurpaschim Province, Nepal

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Abstract
This paper examines the impact of wildlife tourism on the livelihoods of the local population around the Khaptad National Park in Sudurpaschim Province, Nepal, which is popular for Bird sightings and trekking. A detailed household questionnaire elicited information on demographic details, income sources, and consumption expenditure from 224 households. An empirical assessment of the economic impacts of tourism reveals that tourism development has failed to provide tangible benefits to the community. Qualitative evaluation of community perception of tourism impacts and information from key informant interviews reveals contrasting ideologies of diverse stakeholders vis-à-vis park use. With tourism development being mostly the big private, often non-native players in the tourism industry, the residents feel alienated, and this doesn't augur well for conservation efforts. The study village's households are separated into two categories: those that participate in tourism (SVp) and those that do not (SVn). The main null hypotheses are that if tourism has a major direct influence on the community, then SVp would have significantly higher average monthly per capita expenditure (PCE), average monthly per capita income (PCI), and average labor force participation rates (LFPR) in nonagricultural activities, which include tourism, than SVn. All of the mentioned variables (LFPR, PCI, and PCE) would have larger averages for SVn than the CV due to the indirect impact, also known as the trickle-down effect. Both multivariate regression analysis of the factors influencing economic well-being and hypothesis testing based on linear regression were used in the quantitative study(Wang and Sun 2024).Local young people should be prioritized when it comes to direct jobs in the park. A portion of the money made by tourists should be used to further enhance the park and the neighborhoods around it. To shift the nature of tourism's contribution to income and employment from a seasonal to a regular one, alternative tourist attractions in and around the park should be created and promoted.

Keywords:- Wildlife Tourism, income and employment generations, Socio-Economic impact, per-capita income and spending, Tourism participation, Labor force participation rate, Study and Control village, Econometric analysis.

AI & Sustainable Organometallic Chemistry for Carbon Reduction

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Abstract
The study evaluates AI-assisted molecular modeling, green synthetic pathway prediction, and reaction condition optimization for nitrogen- and sulfur-containing organometallic heterocycles. Computational screening tools were applied to predict stability, bioactivity, toxicity, and environmental persistence prior to laboratory synthesis. Comparative carbon accounting analysis revealed that AI-guided virtual screening significantly reduced the number of experimental iterations, lowering reagent use, solvent waste, and energy demand. In addition, AI-based process optimization improved catalytic efficiency and minimized by-product formation, further decreasing associated emissions. The findings demonstrate that AI-driven analytical frameworks not only accelerate compound discovery but also serve as measurable instruments for carbon reduction strategies in chemical research. By embedding sustainability metrics into early-stage molecular design, organometallic chemistry can shift from a resource-intensive model to a predictive, low-carbon paradigm. This work highlights the critical role of digital intelligence in aligning advanced chemical innovation with global climate goals and sustainable development objectives. Graphically illustrates an integrated AI–sustainable chemistry workflow for carbon reduction in organometallic research. On the left, a digital neural network icon represents Artificial Intelligence performing molecular modeling, predictive analytics, and virtual screening of nitrogen–sulfur-containing organometallic heterocycles. Arrows flow from computational screening to a reduced set of optimized molecular structures, symbolizing data-driven selection and minimized experimental trials.At the center, selected eco-efficient organometallic compounds are depicted with highlighted nitrogen (N) and sulfur (S) atoms within heterocyclic frameworks, emphasizing rational molecular design. Beneath this stage, green chemistry indicators—such as reduced solvent bottles, lower energy consumption symbols, and minimized waste icons—demonstrate sustainable synthesis and optimized catalytic performance. On the right, a carbon footprint meter shows a measurable decrease in CO_2 emissions, linking AIassisted design and green synthetic strategies to environmental impact reduction. The overall flow conveys a closed-loop system where AI continuously refines compound design based on biological assessment, sustainability metrics, and carbon accounting analysis. The visual emphasizes the transition from traditional trial-and-error chemistry to a predictive, low-carbon, digitally enabled organometallic research paradigm.

Keywords:-Artificial Intelligence, Sustainable Organometallic Chemistry, Nitrogen–Sulfur Heterocycles, Green Synthesis Optimization, Carbon Footprint Reduction.

AI-Based Sustainable Solutions for Reducing Carbon Emissions

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Abstract
The rapid rise in global carbon emissions has intensified the need for innovative and sustainable solutions to combat climate change. Artificial Intelligence (AI) has emerged as a transformative technology capable of supporting environmental sustainability by optimizing resource utilization, enhancing energy efficiency, and enabling data-driven decision-making. This study explores the role of AI-driven sustainable approaches in reducing carbon footprints across multiple sectors, including energy, transportation, manufacturing, and urban infrastructure. AI technologies such as machine learning, predictive analytics, and intelligent automation enable organizations to monitor emissions, forecast energy demand, and optimize operational processes. Smart energy management systems powered by AI can improve the efficiency of renewable energy integration, reduce energy wastage, and support the transition toward low-carbon economies. In transportation, AI-based route optimization and traffic management systems minimize fuel consumption and greenhouse gas emissions. Similarly, AI-enabled smart manufacturing and supply chain optimization help industries reduce material waste and energy consumption while improving productivity. Furthermore, AI supports the development of smart and sustainable cities through intelligent infrastructure planning, real-time environmental monitoring, and carbon-tracking systems. By leveraging large datasets and advanced algorithms, AI can identify patterns, predict environmental impacts, and recommend sustainable strategies for policymakers and organizations. However, the implementation of AI solutions must also address challenges such as energy consumption of data centers, ethical considerations, and data governance. The findings highlight that integrating AI with sustainable development strategies can significantly contribute to carbon footprint reduction and environmental conservation. The study emphasizes the need for collaborative efforts among governments, industries, and research institutions to develop responsible AI frameworks that promote sustainability. Ultimately, AI-driven sustainable approaches have the potential to play a critical role in achieving global climate goals and fostering a more resilient and environmentally responsible future.

Artificial Intelligence in Education for Sustainable Development: Opportunities, Ethical Challenges, and Pathways for Transformative Learning

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Abstract

Artificial Intelligence (AI) is increasingly becoming the system in education and is increasingly becoming a strategic facilitator of Education for Sustainable Development (ESD) in the United Nations Sustainable Development Goals, especially in SDG 4 (Quality Education). According to the most recent global monitoring reports, published by UNESCO, digital transformation-related policies have become integral to the national education policies of most of the member states, which can be evaluated as a systemic dedication to technology-mediated learning (UNESCO, 2023). Besides, according to the results of the survey conducted by UNESCO, only the minor portion of schools and universities now have formal institutional guidance on the use of AI, which indicates a governance gap in the context of the rapid development of its use (UNESCO, 2023). Higher-education parallel surveys indicate that AI tools are widely used by instructors and learners, showing that AI technologies of generative and adaptive AI are rapidly spread in pedagogical, research, and assessment practices. Empirical sources show that adaptive learning systems based on AI enhance student engagement, real-time feedback, and allow an instructional design based on data. Systematic reviews show that AI-enabled personalization has positive relations with academic performance, especially in the context of STEM and competency-based learning (OECD, 2022; UNESCO, 2023). AI is applied in sustainability education to simulate climate change, analyse environmental data, and systems-thinking pedagogies to enhance the ability of learners to solve complex socio-ecological problems. These strengths are in line with the main competencies of ESD that include critical thinking, anticipatory skills, and collaborative problem-solving. However, there still exist structural inequalities. According to the estimation of the International Telecommunication Union, about 2.6 billion individuals in the world are still offline, which restricts the fair use of AI-based learning systems (ITU, 2023). The issues of algorithmic favouritism, personal data security, the energy costs of AI devices, and digital addiction also make it more difficult to integrate into the model of sustainable development. In this paper, the author will state that AI can significantly contribute to transformative and inclusive education under the conditions of ethical governance systems, effective regulatory policies, and teacher capacity-building programs. Instead of being a purely technological intervention, AI needs to be thought of as a socio-technical system that will be aligned with the principles of sustainability. It is possible to say that the responsible application of AI in education can thus help build resilient learning ecosystems that can prepare learners with the skills necessary to face climate change, social inequality, and global uncertainty in the twenty-first century.

Keywords: Artificial Intelligence (AI), Education for Sustainable Development (ESD), SDG 4, Adaptive Learning, Digital Equity, Ethical AI, Learning Analytics, Sustainable Education, Digital Transformation, Educational Policy.

Role of Chemistry in Renewable Energy

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Abstr`act

Chemistry plays a crucial role in developing renewable energy sources, helping us find sustainable ways to meet our energy needs. As we face the challenges of climate change and depletion of fossil fuels,understanding how chemistry contributes to renewable energybecomes even more important. Chemistry is essential in advancing renewable energy technologies from improving solar cells and biofuel production, developing hydrogen generation, energy storage and carbon capture methods solar energy is one of the most promising sources of renewable energy. Chemistry is essential in harnessing solar energy through photovoltaic cells, which convert sunlight into electricity. Most solar panels are made from silicon and over year scientists have made significant improvement to these materials. By adding small amount of other element known as doping, they can enhance the electrical properties of silicon, making solar cells more efficient. Researchers are also exploring organic photovoltaics (OPVs) which use flexible materials made from polymers. These organic materials can potentially lead to cheaper and lighter solar panels. Another important area where chemistry is vital is in the production of biofuels. Biofuels like ethanol and biodiesel come from organic materials. Biodiesel is made through a chemical reaction called transesterification. In this process oils or fats react with alcohol to produce biodiesel and glycogen. Chemists are working to optimize this process to make it more efficient and environmentally friendly. Additionally, some researchers are looking in using algae as a resource for biofuels due to their rapid growth and high oil content. Hydrogen is gaining attention as a clean energy carrier and chemistry is essential for producing it. The most common method is water electrolysis, where electricity is used to split water into hydrogen and oxygen. Scientists are also exploring newways to produce hydrogen such as using sunlight directly in a process called photoelectrochemical water splitting. As we are in transition to renewable energy, it is also essential to tackle existing carbon emissions. Chemistry plays a key role in carbon capture and utilization technologies. These methods aim to capture CO_2 emissions from power plants and industrial processes. Once captured, CO_2 can be transformed into useful products like fuels or chemicals. This not only help to reduce greenhouse gasemissions but also creates opportunities for a circular economy, where wastes can be reused as a resource.In conclusion Chemistry is essential for advancing renewable energy technologies. From improving solar cell efficiency and enhancing biofuel production to develop hydrogen production methods and energy storage solutions, Chemistry plays a vital role in creating a sustainable energy future.

AI in Smart Manufacturing and Industries

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Abstract
Artificial Intelligence (AI) has emerged as a powerful catalyst for transforming manufacturing, offering unprecedented levels of efficiency, agility, and resilience. This research undertakes an indepth exploration of AI's role within manufacturing, examining its current applications, inherent challenges, and future directions. By analyzing diverse domains such as systemlevel optimization, process monitoring, diagnostics, prognostics, materialpropertymodeling, and humanrobot collaboration, the study reveals the intricate ways in which AI technologies are reshaping industrial processes. The findings highlight AI's transformative potential in optimizing operations, enhancing decisionmaking, and driving innovation across manufacturing ecosystems. Predictive analytics and machine learning models enable manufacturers to anticipate equipment failures, reduce downtime, and maintain consistent quality standards. At the same time, AI fosters adaptability, allowing industries to respond dynamically to evolving market demands and technological advancements. A particular emphasis is placed on humanrobot collaboration, where AI facilitates seamless communication, shared understanding, and adaptive cooperation between humans and machines. This symbiotic relationship underscores how intelligent systems can augment human capabilities, creating safer, more productive, and innovative workplaces. While the opportunities are vast, the research also acknowledges critical challenges such as data quality, interpretability of AI models, and knowledge transfer across domains. Addressing these issues is essential for building resilient, trustworthy, and scalable AIdriven manufacturing systems. Ultimately, this study underscores AI's capacity to propel manufacturing into a new era of sustainability, competitiveness, and innovation. By illuminating both opportunities and challenges, it inspires collaborative efforts and forwardthinking solutions that will shape the future of industrial excellence.

Keywords: Artificial Intelligence, Smart Manufacturing, Industry 4.0, Machine Learning, Automation, Digital Twin, Predictive Maintenance.

Smart Grid Integrated Battery Swapping Stations for Electric Vehicles: A Simulation-Based Analysis of Performance and Grid Support

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Abstract
The formidable challenge posed by the accelerating proliferation of Electric Vehicles (EVs) necessitates the development of sophisticated charging infrastructure capable of mitigating critical limitations: protracted recharging periods, driver range apprehension, and the resultant destabilizing load on the public power grid. Battery Swapping Stations (BSS) emerge as a profoundly effective, high-throughput paradigm, enabling the near-instantaneous replacement of depleted batteries with fully charged equivalents, thereby compressing vehicle downtime to mere minutes. This paper articulates and validates a comprehensive smart grid-integrated BSSframework, meticulously modeled and subjected to rigorous performance simulation within a MATLAB environment. The objective is to establish a system architecture ensuring both highly reliable energy transaction and robust operational support for the electrical infrastructure. The central tenet of the BSS operational strategy is a weighted decision algorithm, implemented to execute optimal real-time battery selection. This algorithm synergistically combines the battery's quantitative State of Charge (SOC) and its qualitative State of Health (SOH), simultaneously enforcing stringent quality thresholds crucial for guaranteeing battery longevity and maximizing user satisfaction. Simulation exercises, conducted across four distinct operational scenarios, definitively affirm the algorithm's precision, yielding selection scores consistently within the narrow, highly effective range of 0.932 to 0.940. Crucially, the aggregate inventory of BSS units is strategically exploited as a dynamic form of distributed energy storage. This capability permits the intelligent sequestration of surplus renewable generation during off-peak demand intervals and the subsequent controlled discharge of this energy back into the grid during periods of peak consumption. The findings unequivocally demonstrate that a BSS network enhanced by smart grid integration not only comprehensively addresses EV charging constraints but also delivers substantial systemic benefits, including significant enhancements in renewable energy utilization, frequency regulation, and voltagestability. This analysis concludes by detailing prerequisite standardization needs, outlining pervasive implementation challenges, and identifying highly fertile research opportunities, underscoring the system's transformative capacity for underpinning sustainable EV ecosystems.

Keywords: Electric Vehicles, Battery Swapping Stations, Smart Grid, Distributed Energy Storage, State of Charge (SOC), State of Health (SOH).

AI-Enabled Learning Outcomes for Sustainable and Low-Carbon Higher Education: A Management Perspective on Private Universities in India

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Abstract

In the contemporary global context, the transition toward sustainable development and a low-carbon economy has positioned higher education institutions as critical agents of change, particularly private universities in India that are known for their adaptability and innovation. This study explores AI-enabled learning outcomes and their role in fostering sustainable and low-carbon higher education from a management perspective. It emphasizes how artificial intelligence-driven systems, including adaptive learning platforms, predictive analytics, and data-driven decision-making tools, enhance teaching-learning processes by making them more personalized, efficient, and resource-optimized. These technologies contribute significantly to reducing environmental impact by minimizing paper usage, lowering energy consumption through digital delivery modes, and decreasing dependency on physical infrastructure. From a managerial standpoint, the integration of AI supports strategic planning, academic monitoring, and efficient resource allocation by providing real-time insights into student performance, engagement patterns, and institutional operations. Furthermore, AI-enabled education promotes critical learning outcomes such as sustainability awareness, environmental responsibility, and green innovation competencies among students, preparing them to address future ecological and economic challenges. The study also highlights the role of virtual classrooms, online assessments, and smart campus systems in reducing carbon footprints while maintaining academic quality. However, the adoption of AI in private universities is not without challenges, including issues related to digital infrastructure, data privacy and security, faculty readiness, and financial investment constraints. Despite these barriers, the research concludes that AI-enabled learning frameworks offer a transformative pathway toward achieving sustainable and low-carbon higher education in India. It suggests that institutional leadership must prioritize policy support, capacity building, and technological investment to effectively implement AI-driven strategies and ensure long-term sustainability outcomes.

Keywords: AI-enabled learning, Sustainable higher education, Low-carbon education, Private universities in India, Learning outcomes, Educational management, Green innovation

Application of ChatGPT and LLMS

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Abstract

The emergence of Large Language Models (LLMs), such as ChatGPT, has transformed artificial intelligence by enabling sophisticated natural language processing and interaction capabilities, impacting diverse sectors including biomedicine, education, software development, and business automation. This report provides a comprehensive exploration of these applications through a detailed literature review, comparative analysis, and discussion of enabling tools and technologies. In biomedicine, LLMs facilitate tasks like medical text summarization and question answering, while in education, they support personalized learning and adaptive tutoring systems. Software development benefits from code generation and debugging aids, and business applications leverage LLMs for customer service automation and data analytics. A comparative analysis evaluates ChatGPT against models like DeepSeek, Claude, Gemini, and Qwen, using benchmarks such as MMLU (87.2% for ChatGPT, 88.5% for DeepSeek) and HumanEval (80.5% for ChatGPT, 84.9% for Claude), highlighting trade-offs in accuracy, efficiency, and multimodal capabilities. Despite their versatility, LLMs face challenges, including biases in training data, ethical concerns, and high computational demands, which necessitate robust integration strategies. The study further examines the critical role of tools and technologies, such as frameworks (e.g., LangChain, Hugging Face Transformers), APIs (e.g., OpenAI, Anthropic), and LLMOps platforms (e.g., Pinecone, Arize), in enabling scalable and ethical deployment of LLMs. Best practices, including prompt engineering, security measures, and bias mitigation, are essential for addressing risks like hallucinations and privacy issues. Looking ahead, future directions point toward developing smaller, more efficient models for resource-constrained environments, autonomous AI agents for proactive task automation, and multimodal systems integrating text, images, and audio for applications in healthcare diagnostics and creative industries. Personalization through fine-tuning and federated learning promises tailored solutions in education and mental health, while ethical advancements, such as improved fact-checking and equitable AI frameworks, are vital for societal trust. By leveraging emerging technologies like retrieval-augmented generation and exploring interdisciplinary applications, this thesis underscores the potential of LLMs to foster sustainable human-AI collaboration, driving innovation while addressing current limitations to ensure inclusive and responsible AI adoption across global sector

Intelligent Energy Analytics and Sustainable Design Strategies for Carbon Footprint Minimization in Electronics Laboratories"

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Abstract
The rapid expansion of electronics laboratories in academic and research institutions has led to a significant increase in energy consumption and associated carbon emissions due to high-power instrumentation, computing infrastructure, cooling systems, and frequent hardware prototyping. This study proposes an integrated framework titled *"Intelligent Energy Analytics and Sustainable Design Strategies for Carbon Footprint Minimization in Electronics Laboratories."* The framework combines artificial intelligence (AI)–based energy analytics with sustainable engineering practices to systematically reduce operational and embodied carbon emissions. The proposed model employs machine learning algorithms for real-time energy monitoring, load forecasting, anomaly detection, and predictive maintenance of laboratory equipment. Smart scheduling and AI-driven HVAC optimization are incorporated to minimize idle power losses and cooling demand. Additionally, sustainable design strategies—including low-power circuit optimization, virtualization through digital twins, renewable energy integration, and lifecycle-based procurement—are implemented to address both direct and indirect emission sources. A carbon accounting methodology based on Scope 1, Scope 2, and Scope 3 emission analysis is integrated into the system to quantify environmental impact. Simulation results indicate that the proposed intelligent energy management approach can achieve an estimated 20–40% reduction in electricity-related emissions and up to 30% reduction in material waste from hardware prototyping activities. The framework further enhances equipment lifespan and reduces electronic waste through predictive analytics. The findings demonstrate that combining AI-driven energy intelligence with sustainable laboratory design provides a scalable pathway toward low-carbon and net-zero electronics research environments. The proposed approach offers practical guidelines for engineering institutions seeking measurable and data-driven carbon footprint minimization strategies.

Keywords: Artificial Intelligence, Energy Analytics, Sustainable Electronics, Carbon Footprint Reduction, Smart Laboratories, Green Engineering, Predictive Maintenance.

Carbon-Aware AI Infrastructure for Data Science Departments: Integrating Cloud Optimization, GPU Efficiency, and Sustainable Education Practices

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Abstract
The rapid expansion of artificial intelligence (AI)–driven research and instruction in Data Science departments has substantially increased energy consumption due to cloud computing services, on-premise servers, and GPU-intensive machine learning workloads. These infrastructure demands contribute significantly to institutional carbon emissions, particularly through electricity use and embodied hardware impacts. This study proposes a comprehensive framework titled *"Carbon-Aware AI Infrastructure for Data Science Departments: Integrating Cloud Optimization, GPU Efficiency, and Sustainable Education Practices."* The framework unifies intelligent workload management, energy-efficient hardware utilization, and sustainability-oriented academic governance to minimize the carbon footprint of data science ecosystems. The proposed system employs AI-based carbon-aware workload scheduling that dynamically allocates computational tasks across cloud and local clusters based on real-time carbon intensity, energy pricing, and resource utilization. GPU efficiency is enhanced through adaptive batch sizing, mixed-precision training, virtualization, and idle-power minimization strategies. At the infrastructure level, thermal-aware resource orchestration and renewable energy integration are incorporated to reduce operational emissions. Additionally, a curriculum-level sustainability model embeds carbon accounting, green coding practices, and energy-efficient algorithm design into coursework and laboratory activities, fostering environmentally responsible computing behavior among students and researchers. A lifecycle-based carbon assessment methodology is implemented to quantify Scope 2 emissions from electricity consumption and Scope 3 emissions associated with hardware procurement and replacement cycles. Analytical modeling and simulation results indicate that integrating carbon-aware cloud orchestration with optimized GPU utilization can reduce energy consumption by 25–40%, while curriculum-driven behavioral interventions further decrease unnecessary computational loads. The findings demonstrate that combining AI-enabled infrastructure optimization with sustainable educational practices offers a scalable pathway toward low-carbon, energy-resilient Data Science departments. The proposed framework provides a practical blueprint for academic institutions aiming to align advanced AI research with institutional sustainability and net-zero objectives.

Keywords: Carbon-Aware Computing, Sustainable AI Infrastructure, Green Cloud Computing, GPU Energy Optimization, Data Science Education, Carbon Accounting, Energy-Efficient Machine Learning.

Toward Sustainable Data Science Ecosystems: AI-Driven Energy Optimization of Cloud, Server, and GPU Clusters with Curriculum-Level Carbon Governance"

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Abstract
The exponential growth of data-intensive research, cloud computing adoption, and GPU-accelerated machine learning in academic environments has significantly increased the carbon footprint of Data Science departments. Energy consumption from cloud platforms, on-premise servers, and high-performance GPU clusters contributes substantially to operational (Scope 2) emissions, while frequent hardware upgrades add embodied (Scope 3) carbon impacts. This study proposes a comprehensive framework titled *"Toward Sustainable Data Science Ecosystems: AI-Driven Energy Optimization of Cloud, Server, and GPU Clusters with Curriculum-Level Carbon Governance."* The framework integrates intelligent infrastructure management with institutional sustainability policies to create a low-carbon and energy-efficient data science ecosystem. The proposed approach employs AI-driven energy analytics to monitor real-time resource utilization across cloud services, server farms, and GPU clusters. Carbon-aware workload scheduling dynamically allocates computational tasks based on energy efficiency, thermal conditions, and grid carbon intensity. Advanced optimization techniques—including adaptive GPU scaling, mixed-precision computation, virtualization, and energy-proportional server management—are implemented to reduce idle power consumption and improve computational efficiency. Additionally, renewable energy integration and intelligent cooling optimization are incorporated to further minimize operational emissions. Beyond infrastructure optimization, the framework introduces curriculum-level carbon governance by embedding green computing principles, carbon accounting methodologies, and energy-efficient algorithm design into data science education. This dual-layer strategy aligns technical optimization with behavioral and policy-level interventions. A lifecycle carbon assessment model quantifies emissions reductions achieved through both operational efficiency and responsible hardware management. Simulation and analytical results demonstrate that the integrated framework can reduce energy consumption by 30–45% across AI-intensive workloads while enhancing resource utilization and extending hardware lifespan. The study establishes a scalable blueprint for transitioning academic Data Science departments toward sustainable, carbon-aware, and net-zero computing ecosystems.

Keywords: Sustainable Data Science, Carbon-Aware Computing, Green Cloud Infrastructure, GPU Energy Optimization, AI-Driven Energy Analytics, Carbon Governance, Energy-Efficient Machine Learning.

A Holistic Green Computing Model for Data Science Departments: Infrastructure Optimization and Sustainability-Driven Curriculum Design

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Abstract
The rapid growth of computational demand in Data Science departments—driven by cloud computing, GPU-intensive machine learning, and high-performance research workloads—has led to a substantial increase in energy consumption and associated carbon emissions. Addressing this challenge requires an integrated approach that combines technical infrastructure optimization with educational strategies to promote sustainable computing practices. This study presents *"A Holistic Green Computing Model for Data Science Departments: Infrastructure Optimization and Sustainability-Driven Curriculum Design,"* a framework that unifies AI-driven resource management, energy-efficient hardware utilization, and curriculum-level sustainability initiatives. The proposed model employs artificial intelligence for real-time energy monitoring, carbon-aware workload scheduling, and predictive maintenance across cloud services, on-premise servers, and GPU clusters. Energy-proportional computing strategies—including adaptive GPU scaling, virtualization, mixed-precision training, and thermal-aware load balancing—are implemented to minimize operational emissions. In parallel, a sustainability-focused curriculum integrates green coding principles, energy-conscious algorithm design, and carbon accounting into laboratory and research activities, fostering environmentally responsible behavior among students and faculty. A lifecycle-based carbon assessment quantifies both operational (Scope 2) and embodied (Scope 3) emissions, enabling data-driven evaluation of carbon reduction strategies. Simulation results demonstrate that the holistic framework can reduce energy consumption by 25–40% and significantly lower carbon intensity per computational task, while extending hardware lifespan and minimizing e-waste. This study illustrates that combining AI-enabled infrastructure optimization with sustainability-driven curriculum design creates a scalable, low-carbon, and resilient data science ecosystem. The proposed approach provides a practical roadmap for academic institutions aiming to achieve measurable environmental impact without compromising computational capacity or research quality.

Keywords: Green Computing, AI-Driven Energy Optimization, Sustainable Data Science, Carbon Footprint Reduction, GPU Efficiency, Cloud Infrastructure, Curriculum-Level Sustainability.

Toward Net-Zero Academic Data Centers: A Carbon-Aware Resource Management Approach

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Abstract
Academic data centers supporting research and teaching in Data Science and related fields are major contributors to institutional carbon emissions due to high electricity consumption, intensive GPU workloads, and frequent hardware upgrades. Achieving net-zero emissions in such environments requires an integrated approach that combines intelligent resource management with sustainable infrastructure practices. This study presents *"Toward Net-Zero Academic Data Centers: A Carbon-Aware Resource Management Approach,"* a framework that leverages artificial intelligence (AI) for real-time energy optimization, carbon monitoring, and workload scheduling across cloud platforms, on-premise servers, and GPU clusters. The proposed approach employs AI-driven predictive analytics to allocate computational workloads based on energy efficiency, grid carbon intensity, and thermal conditions. Techniques such as adaptive GPU scaling, energy-proportional server management, virtualization, and intelligent cooling optimization are implemented to reduce idle power consumption and operational emissions. In addition, renewable energy integration and dynamic load balancing further enhance the sustainability of data center operations. A lifecycle-based carbon assessment methodology quantifies both operational (Scope 2) and embodied (Scope 3) emissions, providing actionable insights for reducing overall environmental impact. Simulation and analytical modeling demonstrate that the framework can achieve a 30–50% reduction in energy consumption and significantly lower carbon intensity per computational task. The results indicate that carbon-aware resource management, when combined with renewable energy adoption and hardware lifecycle optimization, provides a scalable pathway toward net-zero academic data centers. This study offers a practical blueprint for higher education institutions seeking to align advanced computing infrastructure with institutional sustainability and climate goals.

Keywords: Net-Zero Data Centers, Carbon-Aware Computing, AI-Driven Energy Optimization, GPU Efficiency, Sustainable Academic Infrastructure, Green Cloud Computing, Lifecycle Carbon Assessment.

Automatic Detection of Student's Engagement During Online Learning: A Damage & Mitigation: The Jajarkot- Rukum Earthquake 2023, Nepal

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Abstract
Earthquakes are a recurring reality in the Himalayan region, and Nepal has experienced considerable structural damage as a result of these seismic events. The impact is particularly severe in rural areas, where many homes are built using traditional materials such as mud mortar, stone, and brick. Although these construction methods have long been part of local building traditions and rely on readily available materials, they often lack adequate reinforcement and strong bonding materials. This makes such structures highly susceptible to shaking during earthquakes, and even events of moderate magnitude can lead to extensive damage to buildings and property. This study looks into the typical structural weaknesses found in earthquake-affected areas and outlines several practical approaches to reduce future risks. These include retrofitting vulnerable buildings, improving the quality of construction materials, introducing reinforced concrete bands within masonry walls, and ensuring stronger enforcement of seismic building codes. Alongside these conventional engineering solutions, the study also considers the emerging role of Artificial Intelligence (AI) in the field of earthquake engineering and disaster risk management. Recent technological developments have made it possible to use AI-based tools—such as machine learning models, intelligent structural health monitoring systems, AI-supported sensors, and non-destructive testing methods—to observe and evaluate the condition of structures more accurately. These systems can collect and analyze structural data continuously, allowing engineers to detect early warning signs of damage and assess potential structural weaknesses before serious failures occur. In addition, AI can contribute to the development of earthquake early warning systems and data-driven risk analysis models that support faster response and better preparedness. When combined with sound engineering practices and community awareness initiatives, these technologies offer promising opportunities to enhance the resilience and long-term safety of buildings in earthquake-prone regions.

Keywords: Earthquakes in the Himalayan Region, seismic damages, mitigation, Artificial Intelligence (AI), retrofitting of structures.

AI-Driven Smart Hospitals: Autonomous Energy Management & Carbon Neutrality

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Abstract

Hospital facilities are among the most energy-intensive buildings, operating 24/7 with stringent requirements for air exchange, lighting, and climate control. These operational demands contribute significantly to Scope 1 and 2 emissions. While traditional Building Management Systems (BMS) rely on static schedules, AI-Driven Smart Systems utilize real-time data to create "dynamic equilibrium," aligning energy consumption with actual clinical demand. To evaluate the efficacy of AI-integrated 'Digital Twins' in optimizing hospital HVAC and lighting systems to achieve substantial carbon neutrality without compromising patient safety or comfort. To quantify the reduction in kilowatt-hours (kWh) and CO_2e emissions through AI-driven load shedding. To assess the impact of predictive occupancy modeling on energy waste in surgical suites and outpatient wings. To compare the carbon ROI of AI infrastructure versus traditional retrofitting. The study analyzed data from three 'Smart Hospital' pilots (2024–2025) utilizing AI platforms (e.g., BrainBox AI or Siemens Desigo) across 1.2 million square feet of clinical space. A Time-Series Analysis was used to compare baseline energy usage (pre-AI) with post-implementation phases. Multivariate Regression identified the influence of external weather variables versus internal occupancy on energy flux. ANOVA was performed to ensure that temperature and humidity variances remained within strict medical safety thresholds ($p < 0.05$). AI-driven systems achieved a 24% mean reduction in total building energy consumption. Specific findings include: HVAC Optimization: Predictive modeling reduced 'short-cycling' of chillers, saving 15.2 metric tons of CO_2e monthly. Occupancy-based dimming in non-clinical zones reduced lighting energy by 40%. Thermal comfort and air quality indices maintained a 99.8% adherence to clinical standards, outperforming manual controls. AI is the essential catalyst for transitioning hospitals from high-carbon liabilities to Green Healthcare Systems. By automating energy efficiency, AI enables a 'Smart Hospital' to significantly lower its baseline footprint, providing a scalable model for healthcare decarbonization globally. Health systems should prioritize AI-integrated BMS over simple hardware upgrades. It is recommended that 'Energy-Aware AI' become a standard requirement for all new hospital construction and major renovations to meet 2030 Net Zero goals.

Keywords:- Smart Hospitals, Energy Management, Carbon Neutrality, Green Healthcare, Digital Twins.

Computational Evaluation of Bioactive Compounds from *Ficus exasperate* Leaves as Potential Antihypertensive Agents

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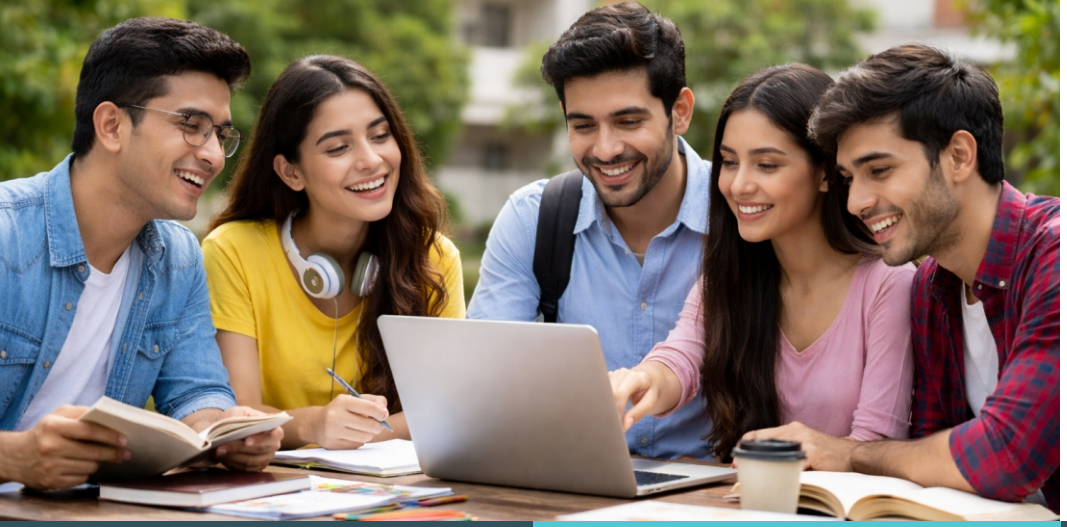
Abstract

Hypertension, a multifactorial chronic disease that affects approximately 1.39 billion of adult populations aged between 30-79 worldwide.Hypertensionsource depends on the complex interactionbetween genetic and environmental factors acting via modifications ofmediators of hypertension pathogenesis such as endothelial nitric oxide synthase (eNOS), angiotensin converting enzyme (ACE) and angiotensin II type 1 receptor among others.*Ficus exasperata*leaves contain bioactive compounds with potential blood pressure-modulating effects, supporting their possible use as antihypertensive agent. The current study employs the computational approaches to explore the therapeutic effects of bioactive compounds from *Ficus exasperata* leaves as a potential antihypertensive agent. High Performance Liquid Chromatography (HPL-C) and Gas Chromatography Mass Spectrometry (GC-MS) analysis of *Ficus exasperata* leaf extract were carried out using standard method. The result of the analysis revealed the presence of 20 polar and 20 non-polar compounds.The compounds against each receptor protein were explored as potential drug candidates on the basis of their binding affinity and root-mean square deviation values. The top two compounds against each protein were found to be lupeol (– 10.4 kcal/mol) and β-sitosterol (- 9.5 kcal/mol) against ART1, hesperidin (-10.8 kcal/mol) and narigerin (-10.9 kcal/mol) against ACE, clionasterol (-11.2 kcal/mol) and hesperidin (-11.1 kcal/mol)againsteNOS. The selected phytochemical compounds were further assessed pharmacokinetically through drug scanning using Lipinski's rule of five to explore their molecular properties and druggability. According to the ADMET analysis, only narigerin fully adhered to theLipinski rule. These findings underscore the potential of this phytocompound as antihypertensive candidates warranting further investigations.

Keywords:- Ficus exasperata, GC-MS, HPL-C, molecular docking, bioactive



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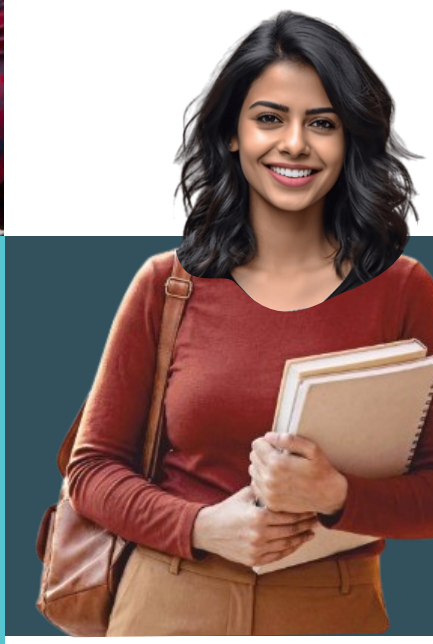

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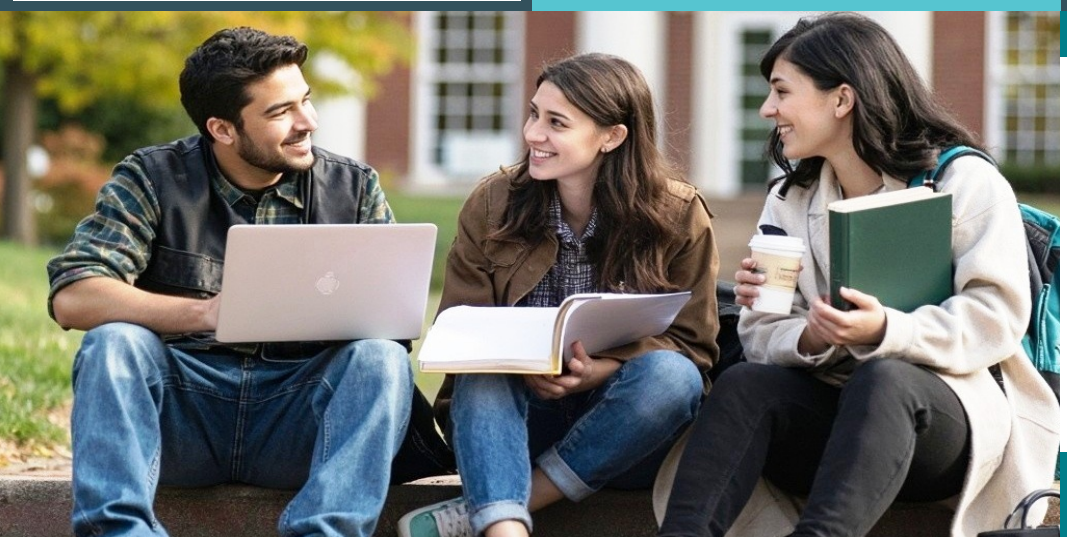

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