



REChronicle

Half -yearly Research Bulletin
September - 2026



RAAJDHANI ENGINEERING COLLEGE (AUTONOMOUS), BHUBANESWAR

*Promoting
Creativity*

*Boosting
Research*

*Exploring
Innovation*

ABOUT RAAJDHANI ENGINEERING COLLEGE :

Raajdhani Engineering College (AUTONOMOUS), Bhubaneswar, was established in 2006 by the Samriddhi Educational Trust of Odisha, a visionary group of professionals with strong backgrounds in education, industry, engineering, and technology.

Spread across 15 acres, the college is located near Mancheswar Railway Station and enjoys a prime location approximately 5 km from the popular Nandankanan Zoological Park. Its strategic location provides excellent connectivity, being just 1 km from the railway station, 5 km from National Highway-5, and 8 km from Biju Patnaik International Airport.

REC is approved by the All India Council for Technical Education (AICTE), New Delhi, and is affiliated with the Biju Patnaik University of Technology (BPUT) and the State Council for Technical Education and Vocational Training (SCTEVT), Government of Odisha.

The college is accredited by the National Assessment and Accreditation Council (NAAC) and is recognized as a Scientific and Industrial Research Organization (SIRO) by the Department of Scientific and Industrial Research (DSIR), Government of India.

Further underscoring its commitment to academic excellence, innovation, and professional development, REC is an institutional member of the Indian Society for Technical Education (ISTE) and the Institution of Engineers (India) (IEI). The college actively participates in the Vigyan Prasar Network of Science Clubs and is also associated with the Institute of Electrical and Electronics Engineers (IEEE), reflecting its strong emphasis on professional growth, technical advancement, and scientific engagement.



RECChronicle



Welcome to the Fourth Edition of REC Chronicles!

It gives us immense pleasure to present the fourth edition of REC Chronicles – 2026, the annual publication that brings together the ideas, achievements, experiences, and aspirations of the REC community. Over the years, REC Chronicles has grown into more than a college publication; it has become a vibrant platform that reflects the academic spirit, creativity, innovation, and collective journey of our institution.

The fourth edition celebrates another year of learning, exploration, and achievement at REC. As the world of education and technology continues to evolve rapidly, our students and faculty have embraced new opportunities, challenged conventional thinking, and contributed meaningfully to the academic and professional landscape. The pages of this edition capture these moments while highlighting the enthusiasm and determination that continue to shape the REC community.

This edition presents a diverse collection of academic accomplishments, innovative projects, research initiatives, student achievements, cultural activities, technical events, and extracurricular pursuits. Alongside these accomplishments, we have given space to the creative voices within our community through articles, poetry, artwork, reflections, and other expressions of imagination. Together, these contributions showcase the multifaceted talents and perspectives nurtured at REC.

A special focus of this edition is on the spirit of innovation, entrepreneurship, research, and industry-oriented learning. From student projects and technical competitions to faculty research, workshops, seminars, internships, and collaborative initiatives, these stories demonstrate our continued commitment to preparing students for a rapidly changing world. Every achievement, whether large or small, represents the dedication, teamwork, and perseverance of the individuals behind it.

REC Chronicles also provides an opportunity to reconnect with the wider REC family. Through alumni experiences, faculty perspectives, student voices, and glimpses of campus life, this edition celebrates the relationships and memories that make our institution unique. We hope these stories inspire meaningful conversations and encourage more members of our community to share their experiences and ideas in the editions to come.

As you turn the pages of REC Chronicles – Fourth Edition 2026, we invite you to celebrate not only what we have accomplished but also what lies ahead. May these stories inspire curiosity, creativity, confidence, and a continued pursuit of excellence. Each page is a reflection of our shared journey, and every contribution adds another chapter to the evolving story of REC.

We sincerely thank our students, faculty members, alumni, and all contributors whose enthusiasm and support have made this edition possible. Your achievements and voices are the heartbeat of REC Chronicles.



Vision:

To foster academic excellence in alignment with the National Education Policy (NEP) 2020 by promoting quality education, innovative research, and meaningful contributions to societal development. The institution aims to address emerging challenges and create sustainable solutions in a rapidly evolving, globally connected, and technology-driven environment.

Mission:

- **To create a conducive and dynamic environment that facilitates greater access to research and development opportunities through expert lectures, Faculty Development Programmes (FDPs), Skill Development Programmes (SDPs), workshops, seminars, and other knowledge-sharing initiatives.**
- **To promote multidisciplinary and interdisciplinary research through collaborative partnerships with industry, academic institutions, government organizations, and community-based organizations at the local, national, and international levels.**
- **To motivate and support faculty members in undertaking impactful research, publishing high-quality research papers in reputed journals and conferences, filing patents, authoring books and book chapters, and disseminating knowledge through recognized academic platforms.**

Quality Policy

Raajdhani Engineering College (Autonomous), Bhubaneswar is committed to creating, sustaining, and continuously enhancing an effective learning environment through a robust Quality Management System and compliance with all applicable statutory and regulatory requirements. The institution strives to emerge as a centre of excellence in scientific and technological education, fostering innovation, research, and holistic development.

Continuous improvement, teamwork, and stakeholder engagement shall remain the key strengths in achieving our institutional objectives, guided by our core value of “Creativity & Innovation.”

From Editorial's Desk



Prof. Sunita Dalei
Asst.Prof. Dept. of CSE

It is a matter of great pride and academic enthusiasm to welcome you to the fourth edition of REChronicle – 2026, a platform that continues to reflect the intellectual curiosity, research spirit, and innovative thinking of the REC academic community. With each edition, REChronicle has evolved as a space for sharing knowledge, encouraging scholarly dialogue, and celebrating the pursuit of meaningful and impactful research.

This edition brings together a diverse collection of research contributions, scholarly articles, technical insights, and thought-provoking perspectives that highlight the evolving dimensions of science, engineering, technology, and society. The contributions presented here demonstrate the commitment of our students, faculty, researchers, and academic collaborators toward addressing contemporary challenges through knowledge, creativity, and evidence-based inquiry.

As research and technology continue to transform the world at an unprecedented pace, the role of academia extends beyond the generation of knowledge. It calls for collaboration, critical thinking, innovation, and the ability to translate ideas into solutions that can create a positive impact on society. REChronicle seeks to encourage this spirit by providing a platform where diverse disciplines and perspectives can come together, inspiring new questions and opening pathways for future exploration.

The fourth edition also celebrates the growing culture of research, innovation, interdisciplinary collaboration, entrepreneurship, and knowledge sharing at REC. It is our endeavour to nurture an academic environment in which emerging researchers are encouraged to explore new ideas, established scholars are inspired to pursue impactful work, and every member of the academic community feels empowered to contribute to the larger body of knowledge.

We envision REChronicle as a continuing journey rather than merely a publication—a journey where ideas are presented, discussed, questioned, refined, and transformed into possibilities. Through this edition, we hope to stimulate intellectual curiosity, encourage meaningful conversations, and inspire our readers to look beyond conventional boundaries in their pursuit of excellence.

I extend my sincere appreciation to all the contributors, reviewers, faculty members, students, and members of the editorial team whose dedication and collective efforts have made this fourth edition possible. Their commitment has enriched the publication and strengthened its role within the academic culture of REC.

As you explore the pages of REChronicle – Fourth Edition 2026, may you discover new perspectives, encounter inspiring ideas, and find motivation to pursue your own journey of inquiry and innovation.

Let this edition be another step towards building a stronger culture of research, creativity, collaboration, and excellence at REC.

Prof. Sunita Dalei
Chief Editor



LEGENDS OF REC



CA. B. Ramprasad Rao
Chairman
Raajdhani Engineering College, BBSR

As Chairman, I am delighted to welcome you to the fourth edition of REChronicle, a platform that continues to celebrate the spirit of innovation, creativity, and intellectual exploration within our institution. With each edition, REChronicle evolves as a meaningful space where diverse ideas, experiences, and perspectives come together to inspire learning and positive change.

In this fourth edition, we continue our endeavour to inform, inspire, and empower our readers through a thoughtfully curated collection of articles, achievements, experiences, and insightful perspectives. The contributions reflect the enthusiasm, talent, and aspirations of our students, faculty, researchers, and alumni.

Our vision is to nurture a vibrant intellectual community where curiosity drives discovery, creativity encourages innovation, and collaboration transforms ideas into meaningful outcomes. I am confident that this edition will inspire every reader to explore new possibilities, embrace challenges, and contribute to a culture of excellence.

Warm Regards,

Chairman

Welcome to the fourth edition of Rechronicle in Research!

It is a privilege to continue the journey of REChronicle through its fourth edition, a platform that celebrates the spirit of research, innovation, and intellectual exploration within the REC community. Over the years, this publication has evolved into a meaningful space where ideas are shared, knowledge is exchanged, and scholarly perspectives come together to inspire new possibilities.

In this edition, we bring together a diverse range of research contributions, emerging ideas, technological innovations, and contemporary academic perspectives that reflect the dynamic nature of knowledge and its growing impact on society. Each contribution represents a commitment to inquiry, creativity, and the pursuit of solutions to the challenges of an ever-changing world.

As we move forward, our endeavour remains to encourage curiosity, critical thinking, interdisciplinary collaboration, and a culture of continuous learning. Through REChronicle, we hope to provide a platform that not only showcases academic accomplishments but also motivates students, faculty, researchers, and readers to explore new horizons and contribute meaningfully to the world around them.

We sincerely thank all our contributors, reviewers, faculty members, students, and editorial team members for their valuable support and dedication in bringing this fourth edition to fruition. Your enthusiasm and scholarly spirit continue to strengthen the vision of REChronicle.

Warm Regards,

Vice-Chairman



Dr. M. K. Palo
Vice Chairman
Raajdhani Engineering College, BBSR





Dr. S. C. Panda
Secretary
Raajdhani Engineering College,
BBSR

FROM SECRETARY'S DESK:

It gives me immense pleasure and pride to welcome you to the Fourth Edition of REChronicle Research Magazine – 2026.

This edition reflects REC's continued commitment to research, innovation, creativity, and academic excellence.

It brings together valuable research insights, emerging ideas, technological developments, and scholarly contributions from our students and faculty.

I sincerely appreciate the efforts of all contributors, reviewers, and editorial team members who have made this edition possible.

May REChronicle 2026 inspire new ideas, foster meaningful collaboration, and strengthen the culture of research and lifelong learning at REC.

FROM DIRECTOR'S DESK (T&P):

It is with immense pride and enthusiasm that I present the Fourth Edition of REChronicle – 2026, reflecting the dynamic growth and continuing journey of REC.

This edition celebrates the dedication, creativity, innovation, and collaborative spirit of our students, faculty, researchers, and the entire REC community.

Over the years, REChronicle has evolved into a meaningful platform for sharing knowledge, showcasing achievements, and celebrating diverse ideas and experiences.

This edition highlights REC's progress in research, innovation, academic excellence, entrepreneurship, and holistic development. May the stories and contributions inspire our community to embrace new possibilities, pursue continuous learning, and contribute to a culture of excellence and purposeful innovation.



Prof. G. S. Mishra
Director (T & P)
Raajdhani Engineering College,
BBSR



Prof. R. Choudhury
Director (Adm. & Fin.)
Raajdhani Engineering College,
BBSR

FROM DIRECTOR'S DESK (admin & finance)

It gives me immense pleasure to present the Fourth Edition of REChronicle – 2026, celebrating the creativity and achievements of our college community.

This edition reflects the enthusiasm, innovation, and intellectual spirit nurtured among our students and staff.

REChronicle continues to provide a vibrant platform for sharing ideas, knowledge, experiences, and accomplishments.

I sincerely appreciate the dedicated efforts of the Chief Editor, Executive Editors, and the entire Editorial Board. May this edition inspire, encourage, and showcase the remarkable talents and contributions of our campus community.



Dr. Bhaskar Patnaik
Principal

Raajdhani Engineering College(Autonomous), BBSR

“Curiosity begins the journey, innovation drives it, and knowledge gives it purpose.”

It is with immense pride and enthusiasm that I welcome you to the Fourth Edition of REChronicle – 2026, a reflection of the vibrant academic, research, and creative spirit of Raajdhani Engineering College. This edition represents our continued endeavour to create a culture where ideas are encouraged, questions are valued, and innovation is transformed into meaningful outcomes.

At REC, we believe that education extends beyond classrooms and textbooks. It is a continuous process of exploration, critical thinking, experimentation, and discovery. In a rapidly changing world shaped by technology and emerging challenges, our responsibility is to

empower learners to think independently, embrace new perspectives, and develop solutions that can make a positive difference to society.

The fourth edition of REChronicle brings together a rich collection of research insights, innovative ideas, academic achievements, technical contributions, and creative expressions from our students and faculty. Each contribution reflects the enthusiasm, perseverance, and intellectual curiosity that continue to strengthen our academic community.

REChronicle is not merely a compilation of articles; it is a reflection of our collective pursuit of knowledge and excellence. Through this platform, we seek to encourage meaningful dialogue, interdisciplinary thinking, research collaboration, and a spirit of innovation that extends beyond institutional boundaries.

I extend my sincere appreciation to the Chief Editor, Editorial Board, faculty members, students, and all contributors whose dedication and thoughtful efforts have made this edition possible. Their commitment has enriched this publication and further strengthened the culture of research and creativity at REC.

As you explore the pages of REChronicle – Fourth Edition 2026, I hope you find ideas that inspire, perspectives that challenge, and stories that motivate you to explore new possibilities.

Let us continue to learn with curiosity, innovate with purpose, and lead with responsibility as we work together towards a brighter and more sustainable future.

Warm regards,

Principal

Raajdhani Engineering College(Autonomous), Bhubaneswar



Message from the Dean Research



Dr. Amaresh Tripathy

Associate Professor

. Dept. Civil Engineering

It is with immense pride and a renewed sense of purpose that I present the Fourth Edition of REChronicle – 2026, a platform that celebrates the spirit of research, innovation, creativity, and knowledge creation at Raajdhani Engineering College. This edition reflects our continued commitment to building an academic environment where curiosity is encouraged, ideas are explored, and research is transformed into meaningful solutions.

At REC, we recognize that research is an essential pillar of institutional growth and societal progress. Our focus extends beyond disciplinary boundaries to promote interdisciplinary research, collaborative learning, technological innovation, and problem-solving. This edition brings together diverse contributions that demonstrate how engineering, science, technology, entrepreneurship, and social perspectives can converge to address emerging challenges and create sustainable impact.

Over the years, REC has continued to strengthen its research ecosystem through research publications, patents, innovation initiatives, industry collaborations, academic partnerships, and knowledge-sharing activities. These efforts reflect our growing emphasis on creating a culture in which students, faculty members, researchers, and industry partners work collectively to transform ideas into impactful outcomes.

Our commitment to innovation and entrepreneurship further strengthens this research ecosystem. Through the Institution's Innovation Council (IIC), hackathons, ideation sessions, workshops, mentoring programmes, and other innovation-driven initiatives, we provide opportunities for our community to explore ideas, develop prototypes, and pursue solutions to real-world problems. By connecting research with innovation and entrepreneurship, we aim to ensure that knowledge generated at REC contributes meaningfully to society and the economy.

The Fourth Edition of REChronicle is therefore not simply a compilation of research contributions; it is a reflection of our collective pursuit of excellence and our vision for a future driven by knowledge, innovation, and collaboration. We hope the work presented in these pages will inspire new questions, encourage interdisciplinary engagement, and motivate our academic community to explore unexplored possibilities.

I extend my sincere appreciation to all students, faculty members, researchers, collaborators, reviewers, and the editorial team whose dedication has contributed to the success of this edition. Their efforts continue to strengthen the research culture and academic identity of REC.

May REChronicle continue to serve as a catalyst for curiosity, innovation, collaboration, and impactful research, inspiring our community to turn challenges into opportunities and ideas into solutions for a better future.

Dr. Amaresh Tripathy

Dean Research

Raajdhani Engineering College, Bhubaneswar



Advisor Insights

Prof. (Dr.) Rakesh Kumar Lenka
Associate Prof. Dept. of CSE
Central University of Odisha.



It is with great pleasure and a profound sense of academic pride that I welcome the Fourth Edition of REChronicle – 2026. Over the years, REChronicle has developed into a vibrant platform for research, scholarly expression, critical inquiry, and the exchange of ideas. This edition marks another significant step in that journey, reflecting the growing culture of intellectual engagement and innovation within our academic community.

In today's rapidly transforming world, the pursuit of knowledge demands more than conventional learning. It requires curiosity to explore the unknown, courage to question established ideas, and creativity to envision new possibilities. The contributions featured in this edition embody these qualities, bringing together diverse perspectives, research insights, analytical reflections, and innovative approaches across multiple domains.

REChronicle provides an opportunity for students, faculty members, researchers, and academic contributors to share their work and engage with a wider community of learners and thinkers. Each contribution represents an individual journey of exploration while collectively demonstrating the strength of our institution's commitment to research, innovation, interdisciplinary learning, and academic excellence.



Dr. Subhendu Kumar Rath

Deputy Registrar BPUT Odisha

It gives me immense pleasure and intellectual satisfaction to extend my warm congratulations on the publication of the Fourth Edition of REChronicle – 2026. This edition marks another meaningful milestone in the continuing journey of a publication dedicated to research, academic inquiry, innovation, and the creative exchange of ideas.

In an era defined by rapid technological advancement, evolving societal needs, and complex global challenges, research has become an essential instrument for creating knowledge and enabling meaningful change. REChronicle reflects this spirit by bringing together the intellectual efforts of our students, faculty members, researchers, and academic contributors who continue to explore new possibilities and contribute to the advancement of knowledge.

The publication has evolved into a valuable platform for multidisciplinary perspectives, emerging research, innovative thinking, and scholarly dialogue. The contributions presented in this fourth edition demonstrate not only academic depth and intellectual rigor but also an awareness of the wider social and technological context in which research takes place. They remind us that the true value of knowledge lies in its ability to inspire solutions, improve lives, and contribute to a more sustainable and progressive society.

I sincerely appreciate the Editorial Team, contributors, reviewers, faculty members, and students for their dedication and collective efforts in bringing this edition to fruition. The thoughtful selection of content, attention to quality, and commitment to excellence are evident throughout the publication. The Fourth Edition also reflects the vibrant intellectual environment of REC and our continued endeavour to nurture creativity, innovation, critical thinking, research aptitude, and academic excellence. I am confident that REChronicle will continue to encourage our academic community to question existing ideas, explore emerging fields, collaborate across disciplines, and pursue knowledge with purpose and integrity.

As we celebrate this edition, let us also look towards the future with renewed enthusiasm. The journey of research is one of continuous discovery, and every question explored today has the potential to become an idea, innovation, or solution that shapes tomorrow.

I am confident that the Fourth Edition of REChronicle – 2026 will engage readers, stimulate intellectual discussion, and inspire students, faculty members, and researchers to set higher goals in their pursuit of knowledge and innovation.

May REChronicle continue to grow as a distinguished platform for academic exchange, research dissemination, creative thinking, and intellectual leadership, contributing to the advancement of our institution and society at large.

Congratulations to the entire REChronicle team on this remarkable edition, and best wishes for its continued success and impact.

Stakeholders' Insights...



Dr. Uttam Ku Jena
Associate Professor
HoD, CSE(Dean S/W)

The publication of the fourth edition of REChronicle marks another remarkable milestone in our continuing journey of academic excellence and innovation. What began as a vision has steadily evolved into a vibrant platform for knowledge, creativity, and intellectual exchange. This edition reflects the dedicated efforts of students, faculty, researchers, and industry partners working together toward shared aspirations.

We are delighted to present the ****fourth** edition of REChronicle, celebrating academic excellence, research, creativity, and innovation. This edition brings together diverse perspectives and highlights the remarkable achievements of our students and faculty. Through collaboration and knowledge sharing, REChronicle continues to inspire interdisciplinary learning and meaningful research. It showcases emerging ideas and technologies with the potential to create a positive impact on society.



Dr. Maheswari Mohanta
Associate. Prof. BS & H

With the launch of the fourth edition of REChronicle, we celebrate another milestone in our journey of knowledge, discovery, and innovation. This edition brings together diverse ideas spanning emerging technologies, sustainability, human development, and intelligent solutions. Each contribution reflects the spirit of curiosity, creativity, and a commitment to meaningful research.



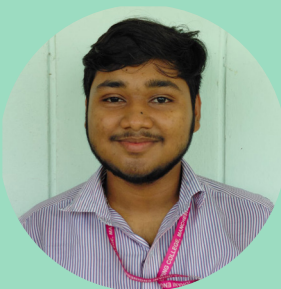
Dr. Upasana Panigrahi
Associate. Prof. ECE

Being part of the evolving journey of REChronicle has allowed us to experience how research expands perspectives, inspires innovation, and creates meaningful change. As students, we take pride in contributing to a culture that encourages curiosity, creativity, and the pursuit of knowledge. This edition reflects our collective enthusiasm for learning, discovery, and interdisciplinary exploration, innovation, and research at REC.



Pinaki Patra
Student, CSE (2nd Year)

We are delighted to present the fourth edition of REChronicle, reaffirming our unwavering commitment to research excellence and academic innovation. Building upon the foundation of previous editions, this volume celebrates impactful research, creative ideas, and meaningful academic contributions. It provides a vibrant platform for dialogue, collaboration, and knowledge exchange across diverse disciplines. Through this edition, we continue to strengthen our research community and encourage a culture of curiosity, exploration, and innovation.



Shivam Das
Student, CSE (2nd Year)





REChronicle

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Research Highlights

Original Article

Tomographic Terahertz (THz) Wave Based Image Reconstruction for Subsurface Crack Identification in Civil Infrastructure Buildings

Surajit Mohanty¹, Subhendu Kumar Pani², Suwendu Tripathy³, Achyutananda Rout⁴, Rajeev Agarwal⁵,
Sunita Dahi⁶

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Abstract - Detection of cracks in civil infrastructure buildings at an early age is very much important to give these structures structural safety, serviceability and long life. Traditional Non-Destructive Testing (NDT) methods, which include visual inspection, ultrasonic testing and infrared thermography, are usually limited to detect concealed or near-surface defects especially on heterogeneous building materials. This paper introduces a Terahertz (THz) wave-based imaging technology to be able to detect and identify subsurface cracks in civil infrastructure buildings non-invasively. Thanks to the capacity of poring non-metallic materials, including concrete, masonry, and composites, THz imaging allows detecting internal discontinuities of high resolution without being in physical contact or preparing the surface. The suggested framework combines THz time-domain imaging and improved signal processing and image reconstruction algorithms to improve the visibility of cracks and depth discrimination. The test studies done on model building materials show that the THz system has the potential to identify the existence of both micro- and macro-level under-surface cracks which cannot be detected by other conventional methods. The findings suggest that THz wave based imaging has a high potential as an intelligent, non-destructive assessment instrument of early damage and structural health monitoring of civil infrastructure buildings.

Keywords - Terahertz imaging, Civil infrastructure buildings, Structural Health Monitoring, Subsurface crack detection, Terahertz time-domain spectroscopy, Non-Destructive Testing.

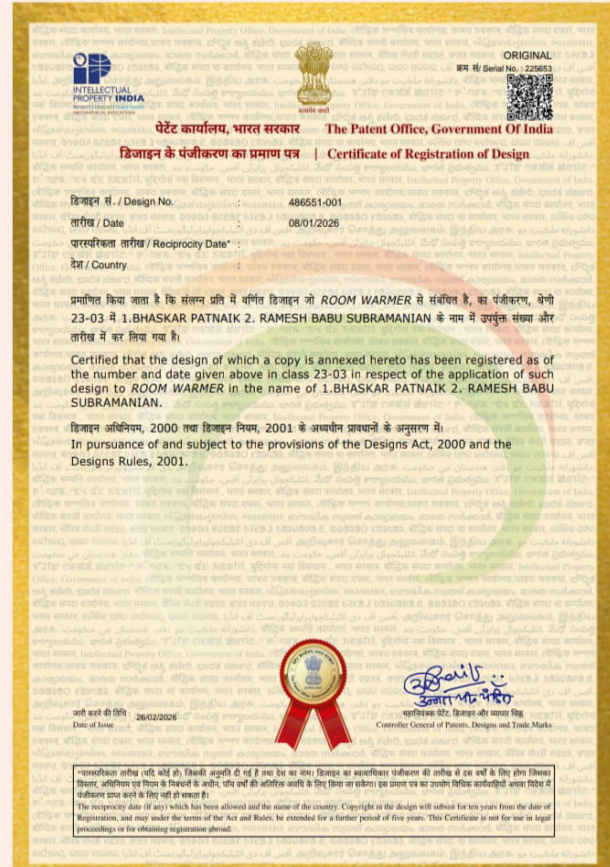
1. Introduction

The issue of structural integrity and durability of civil infrastructure buildings is becoming more and more challenging due to aging, exposure to the environment, and an increase in service needs, and the early identification of internal damage is an essential factor contributing to successful maintenance and risk prevention. Subsurface cracks are a major deterioration factor among others because most of the time, they can go unnoticed until they extend to the surface of the ground or result in serious structural damages. Traditional Non-Destructive Tests (NDT) methods, like visual inspection, ultrasonic tests, ground penetrating radar and infrared thermography, have limitations to detect reliably the shallow or hidden cracks in heterogeneous construction materials, including concrete and masonry. Terahertz (THz) wave-based imaging has become a potential

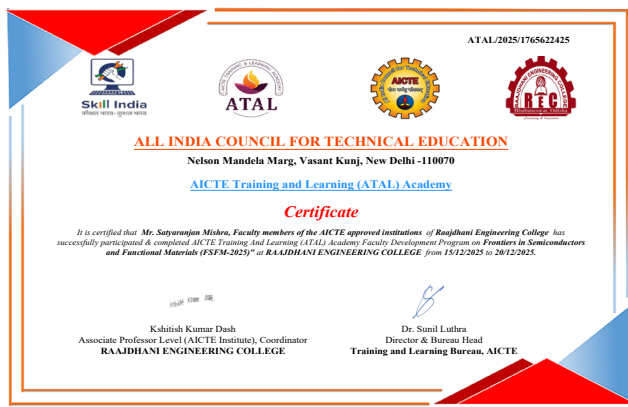
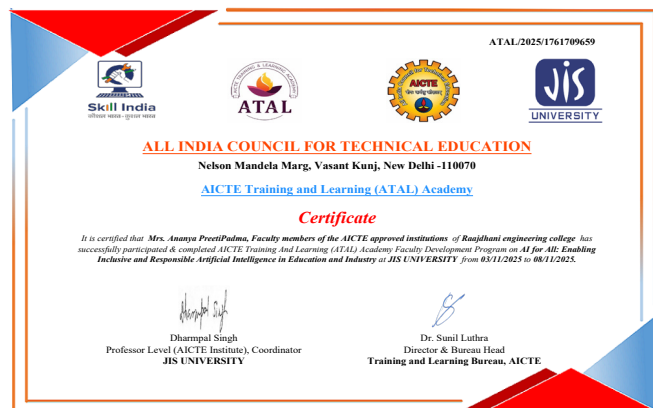
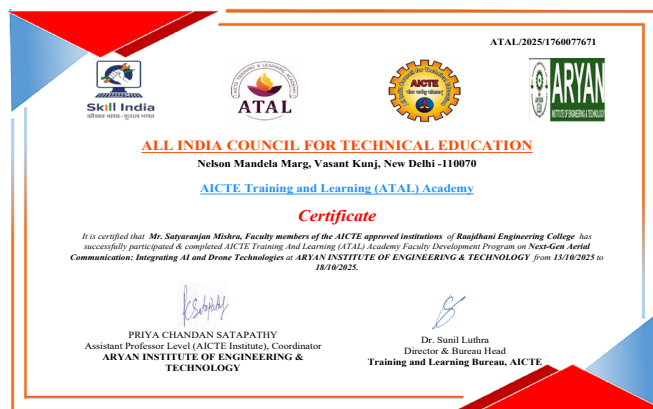
solution to subsurface damage in this scenario because it is non-ionizing, high-spatial resolution, and has a high sensitivity to material discontinuities. The majority of non-metallic building materials are penetrated by THz waves and in time-domain analysis the depth-resolved information allows the detection of internal defects without any physical contact and preparation of the surfaces. The recent developments in the source and detector of THz and signal processing strategies have increased the imaging capability and practical feasibility. Therefore, the THz imaging provides an innovative and smart method of non-invasive subsurface crack detection, which can be used to proactively monitor the structural health of a civil infrastructure building and detect its lifecycle more efficiently. According to Kwak et al., (2024), sub-terahertz imaging showed the ability to measure internal defect depth in real time and, therefore, the



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FACULTY FED PARTICIPATION









Student Achievements & Research Endeavours



Raajdhani Engineering College REC BHUBANESWAR

Congratulations!



Happy Muduli, ECE



Bishnu Prasad Patra, CSE



Ashis priyadarshi sethi, EE



Ananda kumar Behera, EE

Placed In



₹ 7.2 Lakhs
Per Annum

Raajdhani Engineering College REC BHUBANESWAR

Congratulations!



Rahul Kumar Shyanti



Jiban Jyoti Mohanty

Placed In



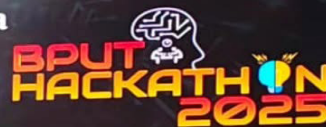
₹ 4.5 Lakhs
Per Annum





B
P
U
T

Biju Patnaik University of Technology, Odisha
ବିଜୁ ପଟ୍ଟନାୟକ ବୈଷୟିକ ବିଶ୍ୱବିଦ୍ୟାଳୟ, ଓଡ଼ିଶା



CONGRATULATIONS! WINNERS!

PS-5



THINK-
BOLTS



The Achievers

CONGRATULATIONS TEAM THINK BOLTS
ON YOUR VICTORY IN THE BPUT HACKATHON-2025,
Your hard work and creativity have made us proud.

RAAJDHANI ENGINEERING COLLEGE
BHUBANESWAR



INNOVATION & ENTREPRENEURSHIP CORNER

EXHIBITION OF FINAL YEAR PROJECTS





Scientific Innovation Excellence Award



IIC Activities

CONVENER'S MESSAGE

Innovation and entrepreneurship have become integral to technical education, and IIC-REC continues to foster creativity, problem-solving, and an entrepreneurial mindset among students and faculty. Over the past two quarters, IIC-REC has strengthened the culture of innovation through hands-on workshops, expert sessions, industrial visits, mentoring programmes, and innovation-driven activities. Students and faculty were encouraged to explore, validate, and refine their ideas while gaining valuable insights into intellectual property, entrepreneurship, funding, incubation, and start-up development. Competitions, pitch events, and interactions with industry experts and start-up ecosystem enablers provided meaningful platforms to showcase talent and transform innovative ideas into promising ventures. As Convener, I extend my sincere appreciation to all contributors and remain confident that IIC-REC will continue to nurture impactful innovations and build a strong pathway from ideation to enterprise creation at the local, national, and global levels.



Dr. Amaresh Tripathy

Associate Professor

Institution's Innovation Council (IIC)

Dean Innovation, REC



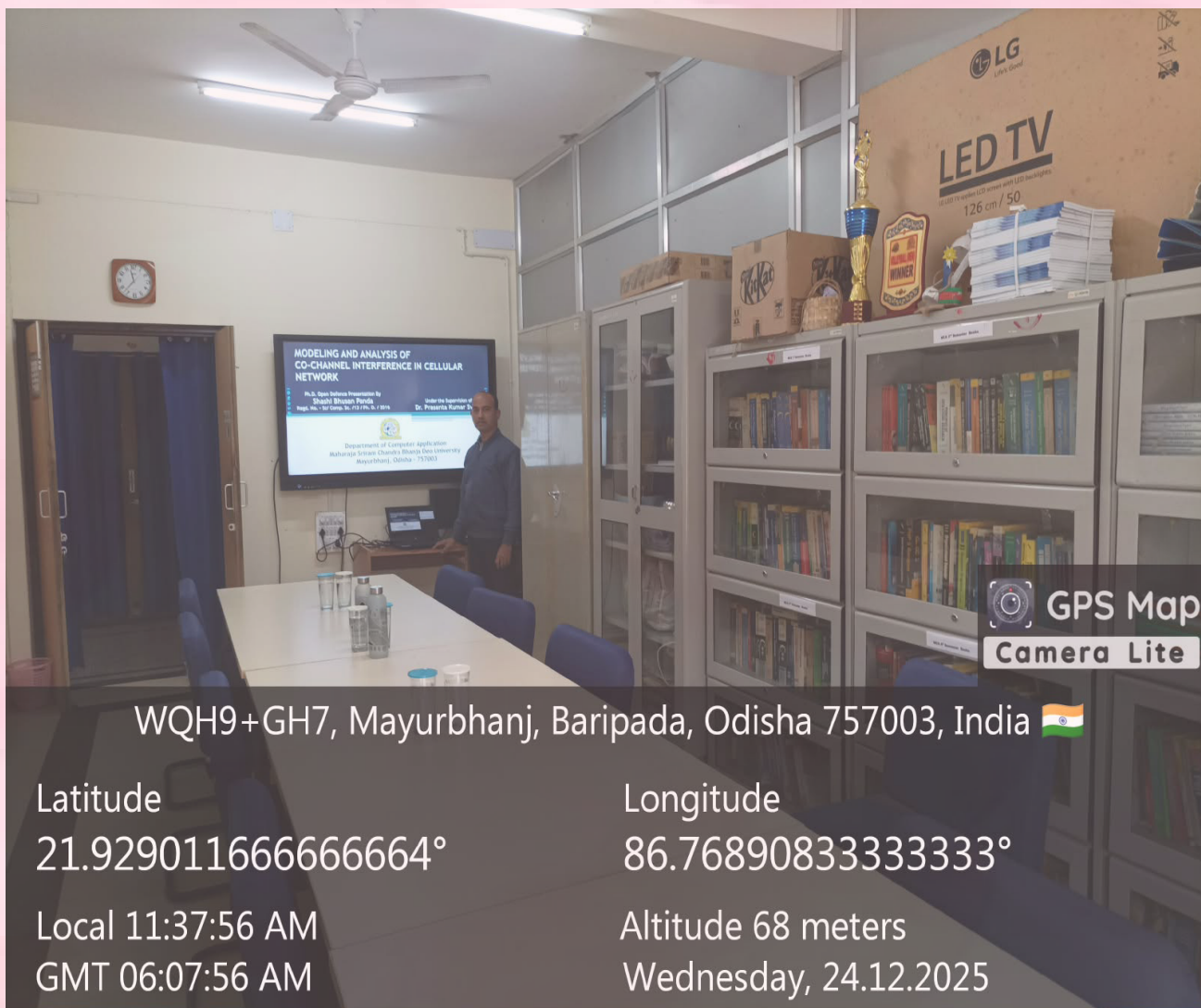
INSTITUTIONAL MILESTONES

DOCTORATES CONFERRED



ABSTRACT

Completing my Doctor of Philosophy (Ph.D.) in Mechanical Engineering from Kalinga Institute of Industrial Technology (KIIT), Deemed to be University, Bhubaneswar, is one of the most cherished and memorable milestones of my academic journey. My doctoral research, titled “A Study on Sustainable Waste Management Practices in Indian Iron Ore Mining Industries,” focused on developing sustainable approaches to waste management in the iron ore mining sector, with emphasis on environmental responsibility, effective waste utilization, and sustainable industrial practices. During this journey, I also had the privilege of contributing to various book chapters, national and international conferences, research journal publications, and patents, which enriched my research experience and strengthened my academic perspective. I am deeply grateful to my esteemed research supervisors, Dr. Suchismita Satapathy and Dr. Lalit Kumar Pothal, for their invaluable guidance, encouragement, and continuous support throughout my doctoral journey. Receiving the official notification for the award of my Ph.D. degree on 20 September 2025 and being part of the 21st Annual Convocation, Class of 2025, was a deeply emotional and proud moment. This achievement represents years of hard work, challenges, sacrifices, patience, and perseverance. It is not merely a degree, but a symbol of determination, self-belief, and the courage to keep moving forward. I consider this achievement a fulfilment of a long-cherished dream and a proud chapter of my life that I will always treasure.



WQH9+GH7, Mayurbhanj, Baripada, Odisha 757003, India 🇮🇳

Latitude

21.929011666666664°

Longitude

86.76890833333333°

Local 11:37:56 AM

GMT 06:07:56 AM

Altitude 68 meters

Wednesday, 24.12.2025

ABSTRACT

The rapid growth in mobile communication networks has led to an unprecedented demand for higher data rates, increased spectral efficiency and better network coverage. However, achieving these goals is hindered by co-channel interference (CCI), a critical factor in cellular network design and performance optimization. CCI arises when multiple transmitters operate on the same frequency, adversely affecting the quality of service (QoS) for users. This thesis focuses on developing analytical models to understand and mitigate CCI in cellular networks. Leveraging tools from queuing theory, cognitive radio network, optimization and machine learning, the study provides insights into the characteristics of CCI in cellular network. We begin by development of analytical queuing models to characterize the interaction between user traffic, resource allocation, and CCI. These models capture key metrics such as packet delay, throughput, utilization and blocking probability, offering a detailed understanding of interference impacts. Multi-Channel Cognitive Radio Networks (CRNs), which enable dynamic and intelligent spectrum access across multiple frequency channels, offer a promising solution to address the CCI challenges. We develop an analytical model that captures the behaviour of co-channel interference in multi-channel CRNs. These models account for the coexistence of primary and secondary users, channel switching dynamics and proposed an interference management framework. We also focus on the modelling and analysis of CCI in Fractional Frequency Reuse (FFR) cellular networks to optimize their design and performance. Considering variations in user density and traffic distribution the key performance indicators, such as signal-to-interference-plus-noise ratio (SINR), throughput and outage probability is determined. Genetic algorithms (GA) has been employed and a simulation model has been developed to reduce CCI. At the end, machine learning based models are applied to cellular network dataset to accurately predict CCI based on signal strength. The findings of this research highlight the interplay between network design parameters, user density, and interference management techniques, offering practical guidelines in improving the design and operation of next generation cellular networks.

Dr. Shashi Bhusan Panda
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COLLABORATIVE VENTURES



Scholarly Articles by Students & faculties

AI-Driven Digital Sovereignty

AI-driven digital sovereignty refers to the ability of a nation or organization to independently develop, deploy, manage, and govern artificial intelligence technologies while maintaining control over critical data, digital infrastructure, computing capabilities, and AI-based systems. As artificial intelligence continues to influence economic development, public administration, social services, national security, and strategic decision-making, digital sovereignty has become increasingly important for achieving technological autonomy, security, and sustainable growth.



Prof. (Dr.) Uttam Kumar Jena
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(Dean Student Welfare)

A key component of AI-driven digital sovereignty is Data Sovereignty. Governments and organizations must ensure that sensitive and valuable data is securely collected, stored, processed, and managed according to their own legal, privacy, and regulatory requirements. This is particularly important in sectors such as healthcare, finance, defence, government services, and critical infrastructure. Maintaining ownership and control of data can help reduce the risks of unauthorized access, external interference, data exploitation, and international regulatory conflicts.

Another major requirement is the development of independent AI and digital infrastructure. This includes domestic data centres, cloud-computing platforms, high-performance computing facilities, AI processors, semiconductor manufacturing capabilities, and secure communication systems. Strengthening these technological resources can reduce dependence on foreign technology providers and enhance a nation's ability to manage critical digital operations independently.

Furthermore, digital sovereignty encourages the development of indigenous AI models and applications. Locally developed Large Language Models (LLMs), computer-vision systems, and domain-specific AI solutions can be designed to support regional languages, cultural contexts, legal requirements, and national priorities. Such technologies can improve digital accessibility while promoting innovation among local researchers, universities, startups, and technology companies.

However, achieving AI-driven digital sovereignty involves several challenges, including high development and infrastructure costs, limited access to advanced semiconductor technologies, shortage of skilled AI professionals, cyber security threats, insufficient high-quality datasets, and difficulties in building competitive AI models. Overcoming these challenges requires strong collaboration among governments, industries, academic institutions, research organizations, and technology developers.

In conclusion, AI-driven digital sovereignty provides a strategic foundation for achieving technological self-reliance, secure digital infrastructure, economic resilience, and responsible AI governance. Investment in domestic computing resources, data protection, semiconductor technology, AI research, and skilled human resources can enable nations to strengthen their control over AI technologies and reduce dependence on external technological ecosystems.

AI-Driven Human Behaviors Recognition and Anomaly Detection

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AI-driven human behaviour recognition and anomaly detection is an advanced area of Artificial Intelligence that focuses on developing intelligent systems capable of observing, interpreting, and analyzing human activities and behavioural patterns. By integrating AI, machine learning, deep learning, computer vision, and sensor technologies, these systems can automatically distinguish between normal

and unusual human behaviour. Modern behaviour-monitoring systems combine video analysis, image processing, audio processing, and real-time sensor data to provide comprehensive behavioural insights.



Advanced AI models, including Convolutional Neural Networks (CNNs), Vision Transformers (ViTs), YOLO-based object detection algorithms, human-pose estimation models, Long Short-Term Memory (LSTM) networks, and Video Transformers, can effectively recognize and classify different human activities. These models can identify behaviours such as walking, running, sitting, falling, fighting, crowd formation, loitering, and other unusual movements. Pose-estimation techniques extract key information about body positions and joint movements, while temporal deep-learning models analyze sequences of actions to understand complex behaviour over time.

Anomaly detection is a fundamental component of intelligent behaviour-monitoring systems. Rather than depending exclusively on predefined activities, AI models can learn patterns associated with normal behaviour and identify significant deviations from those patterns. This capability enables the detection of potentially hazardous or unexpected situations, including falls, aggressive actions, unauthorized movement, accidents, and abnormal crowd behaviour. Once an anomaly is identified, the system can generate real-time notifications or alerts, allowing appropriate human intervention.

The integration of Multimodal AI can further enhance system performance by combining data from cameras, microphones, wearable devices, motion sensors, and environmental sensors. In addition, Edge AI enables data to be processed locally, which can reduce response time, network dependency, and unnecessary transmission of sensitive information.

Despite its advantages, AI-based behaviour recognition involves challenges related to privacy, data security, algorithmic bias, false detections, reliability, and ethical considerations. Therefore, training datasets should be diverse and representative, while systems should incorporate strong data-protection mechanisms, transparency, explainability, and human supervision.

Overall, AI-driven human behaviour recognition and anomaly detection provides a robust foundation for developing intelligent, adaptive, real-time, and predictive monitoring systems. With responsible implementation, these technologies can significantly support applications in healthcare, public safety, workplace security, education, transportation, and smart environments.

Case Study: Galaxy Classification For Predictive Data Analytics

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In 2011, the Sloan Digital Sky Survey (SDSS) hired Jocelyn to develop a machine-learning model for classifying galaxies as elliptical, spiral, or other. The project aimed for about 80% accuracy and approximately 1,000 classifications per second. During data understanding, Jocelyn learned that brightness, color, and shape were the most useful galaxy characteristics. Because SDSS lacked reliable morphology labels, she combined its imaging data with classifications from Galaxy Zoo, creating a dataset of about 600,000 labeled galaxies and 547 columns.

During data preparation, irrelevant and constant columns were removed, missing values and outliers were addressed, and features were standardized. The final analytical table contained 327 descriptive features. Jocelyn tested k-nearest neighbors, logistic regression, and support vector machines. Although class imbalance caused poor minority-class performance, accuracy was prioritized because elliptical and spiral classifications were most important. Feature selection significantly improved performance: logistic regression using 31 features achieved the best results.

The three-class logistic regression model reached 87.979% accuracy on an unseen test set, exceeding the 80% target. Human evaluation supported its performance, although expert agreement was only moderate. The model was deployed in the SDSS pipeline with probability-based manual review and stability monitoring to detect concept drift and trigger retraining when necessary.

Sustainable Waste Management in Rural Areas: A Pathway to Sustainable Development

Dr. Manas Ranjan Das
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Sustainable waste management in rural areas plays an important role in protecting the environment, improving public health, and supporting community development. Rural households generate biodegradable waste, plastic, agricultural residues, and other discarded materials. When these wastes are openly burned or dumped, they create pollution and affect soil and water quality. A sustainable approach focuses on reducing waste, segregating it at source, reusing materials, and recycling wherever possible. Community participation is essential for effective waste management. Local bodies, self-help groups, schools, and farmers can work together to establish collection systems and promote environmental awareness. Organic waste can be converted into compost or biogas, while recyclable materials can be collected and sent to appropriate recycling facilities. These practices reduce the pressure on landfills and create opportunities for local employment. Safe disposal of non-recyclable and hazardous waste also helps protect rural communities. This approach directly supports SDG 12: Responsible Consumption and Production, particularly Target 12.5, which promotes waste reduction through prevention, recycling, and reuse. It also contributes to SDG 6: Clean Water and Sanitation by reducing waste-related contamination of water sources. SDG 11: Sustainable Cities and Communities is relevant because sustainable development includes stronger links between urban, peri-urban, and rural areas. Furthermore, composting and resource recovery support SDG 13: Climate Action by reducing emissions associated with unmanaged waste. Thus, sustainable waste management in rural areas is not merely a cleanliness initiative. It is a community-based development strategy that promotes environmental protection, resource conservation, and a healthier future.

AI-Based Smart Waste Segregation System in the Electronics Industry:

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The rapid growth of the electronics industry has significantly increased the generation of electronic waste (e-waste). Discarded devices such as computers, mobile phones, batteries, circuit boards, cables, and other electronic components contain valuable materials as well as hazardous substances. Traditional methods of waste segregation are often manual, time-consuming, inaccurate, and potentially dangerous for workers. Therefore, an AI-Based Smart Waste Segregation System can provide an efficient and sustainable solution for managing electronic waste. The proposed system uses Artificial Intelligence (AI), Machine Learning (ML), Computer Vision, sensors, and robotic automation to automatically identify and separate different categories of electronic waste. Cameras capture images of incoming waste materials, while AI-based image recognition models classify them into categories such as plastics, metals, batteries, printed circuit boards, cables, and reusable electronic components. Sensors can also detect physical properties such as weight, size, material composition, and the presence of hazardous substances. After identification, an automated conveyor and robotic sorting mechanism directs each item into the appropriate collection container. Deep learning algorithms, particularly Convolutional Neural Networks (CNNs), can improve the accuracy of object recognition and classification. The system can continuously learn from newly collected data, making the segregation process more intelligent over time.

The AI-based system offers several advantages, including improved segregation accuracy, reduced human involvement, faster processing, better worker safety, and increased recovery of valuable materials such as copper, aluminium, gold, and other recyclable resources. It also supports environmentally responsible disposal of hazardous electronic components. Furthermore, the system can be integrated with the Internet of Things (IoT) for real-time monitoring of waste levels, machine performance, and recycling operations. Data analytics can help industries make better decisions regarding waste management and resource recovery. In conclusion, an AI-Based Smart Waste Segregation System represents an innovative approach to solving the growing e-waste problem in the electronics industry. By combining AI, automation, and IoT technologies, industries can achieve efficient recycling, environmental sustainability, and support the development of a circular economy.

Mathematics: The Hidden Language of the Universe

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Before a flower unfolds its petals, before planets trace their paths across space, and before technology transforms imagination into reality, mathematics is already at work. Silent yet powerful, invisible yet present, it shapes the patterns and relationships that govern our world. Mathematics is more than numbers and formulas; it is the hidden language through which the universe expresses itself.

Nature seems to speak in mathematical rhythms. The spiral of a sunflower, the symmetry of a flower, the structure of a seashell, and the branching of trees reveal patterns that echo mathematical principles. Geometry, proportion, symmetry, and sequences shape the beauty we observe in the natural world.

Our modern lives are intertwined with mathematics. Every smartphone we operate, GPS route we follow, digital payment we make, and online platform we use relies on mathematical ideas working in the background. Engineering, architecture, economics, computer science, and scientific research are built upon mathematical foundations. Artificial Intelligence and Machine Learning further demonstrate this connection, drawing upon matrices, probability, statistics, calculus, and optimization.

Yet mathematics is not merely a tool for calculation. It cultivates a way of thinking. It teaches us to question, reason, recognize patterns, analyse problems, and search for elegant solutions. It nurtures patience, precision, creativity, and intellectual curiosity—qualities that extend beyond life.

The beauty of mathematics lies in its universality. An equation needs no translation; its meaning transcends borders, cultures, and languages, connecting minds across generations.

For students, mathematics should not be seen as a subject to pass, but as an opportunity to develop curiosity, confidence, and courage. Every problem solved is a step towards sharper thinking and discovery. When students learn to see mathematics not as a challenge to fear but as a language to explore, they may discover that the numbers on a page are the beginning of a journey.

“Mathematics is not merely a subject; it is the hidden language through which the universe reveals its beauty and possibilities.”

GPU Orchestration for LLM Training: Engineering the Infrastructure of Tomorrow

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IGPU Orchestration for LLM Training: Engineering the Infrastructure of Tomorrow. The rapid evolution of generative artificial intelligence has fundamentally shifted the computing landscape. At the heart of this revolution lie Large Language Models (LLMs)—colossal neural networks containing hundreds of billions of parameters. However, building these models presents a massive engineering hurdle. Training a modern LLM is no longer just a software or algorithmic challenge; it is a massive infrastructure and distributed systems problem. To train these digital brains within reasonable timeframes, engineers must harness the power of thousands of Graphics Processing Units (GPUs) working in perfect synchronization—a discipline known as GPU Orchestration.

The Need for Orchestration: Breaking the Single-GPU Barrier A single modern enterprise GPU possesses incredible computational power, but its onboard memory (VRAM) is entirely insufficient for hosting an LLM during its training phase. A model with 70 billion parameters requires hundreds of gigabytes of memory just to hold its weights, not to mention the additional memory needed for gradients and optimizer states. Because a single chip cannot contain the model, the workload must be split across a vast fabric of interconnected GPUs. GPU orchestration is the software intelligence layer that automates, manages, and optimizes this distributed environment. Without robust orchestration, processors sit idle, network cables choke with data, and training costs skyrocket into millions of dollars. Pillars of Distributed Training Architectures.

To successfully orchestrate an LLM training cluster, infrastructure engineers rely on sophisticated parallelization strategies:

- **Data Parallelism:** The model is replicated across all GPUs, and different batches of the training dataset are fed to each processor simultaneously. The GPUs then synchronize their findings to update the master model.
- **Tensor Parallelism:** For models too large to fit on one chip, individual layers of the neural network are split horizontally. Multiple GPUs work together to calculate a single matrix multiplication.
- **Pipeline Parallelism:** The layers of the model are split vertically across a sequence of GPUs. The data moves through the cluster like an assembly line, where GPU 1 processes the first few layers, passes the intermediate results to GPU 2, and so on.
- **Overcoming the Communication Bottleneck.**

Green Cloud Engineering: Designing a Sustainable Digital Horizon

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The digital revolution has a hidden weight. Every time we stream a video, query a large language model, or train a neural network, a massive array of silicon processors whirs to life in a distant data centre. Today, the infrastructure supporting our digital lives consumes roughly 1-2% of global electricity—a figure rapidly compounding with the explosive growth of artificial intelligence. As future engineers, our responsibility is transitioning from merely building high-performance systems to pioneering sustainable ones. This shift has given rise to a critical new discipline: Green Cloud Engineering.



Green Cloud Engineering moves beyond standard hardware efficiency. While hardware giants continue to design low-power microchips and data centres utilize advanced liquid cooling, software and cloud engineers hold the keys to systemic sustainability. The true battlefield for carbon reduction lies in the code we write, the architectures we deploy, and the algorithms we use to manage cloud resources.

The Principles of Carbon-Aware Software

At the heart of green cloud engineering is the concept of carbon awareness. Traditional cloud applications are designed to respond instantly, scaling up resources whenever demand spikes, regardless of how the underlying power grid is fueled. Carbon-aware computing flips this paradigm by making software adaptable to the carbon intensity of the local energy grid.

Engineers achieve this through two primary programming methodologies:

- Demand Shifting (Temporal): Delaying non-critical, compute-heavy tasks—such as batch data processing, model training, or system backups—to hours when the local power grid is saturated with renewable energy like wind or solar.
- Demand Shifting (Spatial): Dynamically migrating workloads across different geographic data centres. If a data centre in the region is experiencing a cloudy, windless day, the software automatically routes processing queues to a data centre operating under a surplus of clean energy.

Architectural Shifts: Microservices and WebAssembly

From a structural perspective, the choice of cloud architecture heavily influences energy consumption. Monolithic applications that run continuously waste massive amounts of idle compute power. Modern green architectures leverage Serverless Computing, ensuring that code executes only when triggered by an event and scales down to absolute zero when dormant.

Furthermore, the rise of WebAssembly (Wasm) in the cloud represents a massive leap forward. By providing a secure, lightweight binary execution format, Wasm allows engineers to run high-performance code at a fraction of the memory and CPU footprint required by traditional Docker containers or Virtual Machines. Less memory overhead directly translates to reduced energy draw across thousands of distributed servers.

Engineering the Future Responsibly

The ultimate goal of a Green Cloud Engineer is to treat carbon efficiency as a core performance metric, alongside latency, security, and cost. When writing algorithms, optimizing database queries, or structuring API calls, the energy footprint must be factored into the development lifecycle.

As the next generation of technologists, the challenge is clear: we must build a digital ecosystem that expands human capability without exhausting the planet's resources. The future of engineering isn't just about making things faster or smarter—it is about making them sustainable.

Requirement of Scalability for Economic Sustainability: A big Dilemma

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This paper's goal is to examine how scalability affects the sustainability of any entire environmental, human, ecological, or business anywhere. Scalability is the ability of a business to expand without losing clients, sacrificing quality, or altering the organization's essential values. In this context whether expansion is required is a big question that has to be answered. As per the concept for a sustainable entity Availability, reliability, capacity, affordability, and marketability are the five qualities that make an entity sustainable. In addition to these five skills, scalability is a special problem for many organizations, particularly small ones. Because SMEs (small and medium-sized enterprises) have particular difficulties, scalability aims to characterize how sensitive the entity is to changes in the scope of activities. Bigger companies benefit from well-established customs, cultures, and recognition. Small companies and start ups operate in a setting where their cultures and brands may still be developing, and as their operations grow in size, the caliber of their goods and services may also shift. Thus, this study investigates the hypothesis that organizations might not be scalable since they may inherently alter their essential operations and incur losses as a result of expansion.

Keywords: small business growth, sustainability skills, scalability, economic sustainability, and SME sustainability

RELATIONSHIP BETWEEN CELESTIAL CYCLES AND AYURVEDIC BIOLOGICAL RHYTHMS

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Ayurveda, the traditional Indian system of medicine, emphasizes the importance of Kala (time), daily routines (Dinacharya), and seasonal regimens (Ritucharya) in maintaining health. Modern chronobiology similarly demonstrates that living organisms possess biological rhythms synchronized with environmental cycles, particularly the light-dark cycle and seasonal changes. This article explores the possible relationship between celestial cycles and Ayurvedic biological rhythms from both traditional and contemporary scientific perspectives. Particular attention is given to solar cycles, seasonal variation, circadian rhythms, and the traditional concepts of Dosha and Agni. Existing literature suggests that Ayurveda recognized the importance of temporal regulation of physiological processes long before the emergence of modern chronobiology. However, direct causal effects of planetary or lunar positions on human physiology remain scientifically unestablished.

Introduction

The Earth is continuously influenced by astronomical cycles, including rotation around its axis, revolution around the Sun, and variations in daylight across seasons. These environmental changes influence temperature, light exposure, sleep patterns, hormonal regulation, metabolism, and behaviour. Modern science describes these periodic physiological changes through the field of chronobiology.

Ayurveda also gives considerable importance to time. Dinacharya describes appropriate daily activities, while Ritucharya describes adaptations to seasonal changes. Classical Ayurvedic literature divides the year into six seasons and relates seasonal transitions to changes in physiological strength and Dosha activity.

Celestial Cycles and Biological Rhythms

The most scientifically established celestial influence on human biological rhythms is the solar light-dark cycle. Light received by the eyes helps regulate the circadian system, which influences sleep, hormone secretion, body temperature, metabolism, and other physiological functions. Ayurveda's recommendation of regular daily routines can therefore be examined alongside modern understanding of circadian synchronization.

The annual solar cycle produces seasonal changes in daylight, temperature, humidity, and food availability. Ayurveda's Ritucharya recommends changes in diet, physical activity, sleep, and lifestyle according to these environmental conditions. Ayurvedic literature associates Uttarayana and Dakshinayana with the annual movement of the Sun and describes corresponding seasonal changes.

Ayurvedic Interpretation

Ayurveda proposes that physiological balance varies with time and environmental conditions. Traditional descriptions associate different periods and seasons with variations in Vata, Pitta, and Kapha, as well as changes in Agni. Modern research on chronobiology and seasonal biology provides a potentially useful framework for investigating these traditional observations. Studies have already discussed Ayurvedic concepts such as Dinacharya, Ritucharya, and Dosha in relation to biological clocks and chronotherapy.

AI-DRIVEN POWER GRID STABILITY AND RENEWABLE ENERGY INTEGRATION: TOWARD INTELLIGENT POWER SYSTEMS

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The rapid integration of solar photovoltaic and wind energy is transforming conventional power systems into complex, inverter dominated networks. The intermittent nature of renewable generation introduces uncertainties in power balance, voltage regulation, and frequency stability. Artificial Intelligence (AI) and Machine Learning (ML) are emerging as powerful tools for addressing these challenges by extracting useful information from large volumes of real-time and historical grid data. AI-based models can perform short term load forecasting, renewable generation prediction, contingency analysis, and online stability assessment. Techniques such as artificial neural networks, support vector machines, deep learning, and reinforcement learning can identify nonlinear relationships that may be difficult to capture using conventional analytical approaches. These capabilities can assist system operators in making faster and more informed decisions under rapidly changing operating conditions.

AI can also contribute directly to intelligent grid control and energy management. Reinforcement-learning algorithms can be developed for adaptive frequency regulation, while ML-based controllers can coordinate renewable sources, battery energy storage systems, and power-electronic converters to maintain system stability. AI-based predictive maintenance can further identify abnormal operating conditions before equipment failures occur. However, practical deployment requires attention to data quality, computational requirements, cybersecurity, model interpretability, and the reliability of AI decisions. The combination of physics-based power-system models with data-driven and physics-informed AI approaches offers a promising pathway toward trustworthy intelligent control. As renewable penetration continues to increase, AI is expected to become an important enabling technology for real-time monitoring, stability assessment, forecasting, and optimal control. Thus, the convergence of AI, power electronics, energy storage, and renewable generation can play a significant role in developing resilient, efficient, and sustainable power grids.

PASSIVE DAYTIME RADIATIVE COOLING

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Passive Daytime Radiative Cooling materials represent a transformative technological approach to thermal management that achieves sub-ambient surface temperatures without consuming any electricity or external fuel by exploiting the ultra-cold vacuum of deep space, which sits at roughly 3 Kelvin, as a natural thermodynamic heat sink. To achieve a net cooling effect even under intense direct sunlight, these engineered materials must precisely balance two distinct optical properties: exceptionally high solar reflectance exceeding 95 percent across the ultraviolet, visible, and near-infrared spectrums to prevent the absorption of incoming thermal energy, and extremely high long-wave infrared thermal emissivity above 90 percent specifically within the 8 to 13 micrometers atmospheric transparency window. This specialized window allows terrestrial thermal radiation to bypass atmospheric gases like water vapour and carbon dioxide, escaping directly into outer space. When the thermal energy emitted through this radiative pathway surpasses the combined heat gained from solar irradiance and ambient convection, the surface temperature drops significantly below the surrounding air temperature. Researchers and engineers have successfully translated these physical principles into a diverse array of advanced material formats, ranging from porous polymer coatings and nanoparticle-laden paints designed for large-scale building rooftops to multilayer, nonporous polyethylene textiles tailored for wearable personal cooling. The practical implementations of these materials are profound, offering unprecedented efficiency gains in building envelope cooling by drastically reducing interior air conditioning loads, enhancing photovoltaic solar cell efficiency by bleeding off performance-degrading waste heat, managing thermal loads for parked vehicles, and boosting the operational yields of atmospheric water and thermoelectric generation systems. However, widespread commercial adoption still faces notable technical hurdles, including long-term weathering, dirt accumulation, and ultraviolet degradation that gradually erode solar reflectance, seasonal challenges like sub-ambient overcooling in colder winter climates that drive up space heating demands, heavy cloud cover which narrows the atmospheric transparency window, thereby driving ongoing scientific innovations toward self-cleaning super hydrophobic surfaces and dynamic switchable cooling materials designed to intelligently adapt to shifting thermal requirements throughout the changing seasons.

AI Ethics: Can Machines Make the Right Decisions?

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Artificial Intelligence (AI) is rapidly transforming the way important decisions are made in modern society. AI systems are now being used in critical areas such as medical diagnosis, bank-loan approval, employee recruitment, and criminal-justice risk assessment. These systems can analyze enormous amounts of information and provide decisions or recommendations within seconds. However, an important ethical question remains: Can machines truly make the “right” decision? Although AI can improve efficiency and accuracy, making a morally correct decision is a much more complex challenge.

The Problem of Algorithmic Judgment

AI systems do not understand moral values, empathy, emotions, or personal circumstances in the same way human beings do. Instead, they process information using mathematical models and optimization techniques. Their decisions depend largely on the data used to train them. If historical data contains social inequalities or human biases, an AI system may learn and reproduce those biases on a much larger scale.

For example, automated recruitment systems may unintentionally discriminate against female candidates if the historical hiring data reflects gender-based inequalities. Similarly, risk-assessment systems used in criminal justice have demonstrated racial bias. These examples show that AI does not automatically become fair simply because it is computer-based. The quality and fairness of its decisions depend heavily on the objectives, data, and design choices made by humans.

Another major concern is the “black box” problem. Many advanced deep-learning systems can produce highly accurate results, but their internal reasoning may be difficult to understand. If an autonomous vehicle makes a sudden decision or a healthcare AI recommends denying a particular treatment, users may not be able to determine exactly why the system reached that conclusion. This lack of transparency makes it difficult to evaluate decisions and assign responsibility when something goes wrong.

Current Technical and Regulatory Countermeasures

To reduce these ethical risks, governments, researchers, and organizations are developing various technical and regulatory safeguards.

- **Regulatory Guardrails:** Governments are introducing legal frameworks to control high-risk AI applications. For example, the European Union’s AI Act establishes restrictions and requirements for certain high-risk uses of artificial intelligence.
- **Algorithmic Auditing:** Organizations can conduct regular audits to identify unfair patterns, discrimination, and potential biases in AI systems. Explainable AI (XAI) techniques can also help make model decisions easier to understand and evaluate.
- **Human-in-the-Loop Governance:** Human oversight is essential when AI is used for sensitive or high-impact decisions. Under this approach, AI provides recommendations or analysis, while humans retain responsibility for reviewing the information and making the final decision.

Dielectric Resonator Antennas for 6G: Design and Optimization

Prof. Biswajit Pradhan, ECE



The evolution of sixth-generation (6G) wireless communication requires extremely high data rates, ultra-low latency, and massive device connectivity, driving the adoption of millimeter-wave (mmWave) and sub-terahertz (sub-THz) frequency bands. At these high frequencies, conventional metallic printed antennas experience significant conduction and propagation losses, signal attenuation, and reduced radiation efficiency. Dielectric Resonator Antennas (DRAs) have therefore emerged as a promising alternative because of their low conduction losses, high radiation efficiency, and suitability for high-frequency applications.

Recent developments in DRA technology focus on multimode excitation, enhanced impedance bandwidth, compact configurations, and integration with massive Multiple-Input Multiple-Output (MIMO) systems. Advanced feeding techniques, particularly Substrate Integrated Waveguide (SIW), can further improve antenna performance. Met surface structures enable dynamic beam steering, while graphene-based reconfigurable layers provide adaptive frequency tuning and reconfiguration. In addition, three-dimensional (3D) additive manufacturing offers flexible, economical, and precise fabrication of complex DRA geometries.

Machine Learning and Optimization Frameworks

Traditional full-wave electromagnetic simulation tools, such as Ansys HFSS and CST Studio Suite, solve Maxwell's equations using numerical techniques but become computationally expensive for large sub-THz massive MIMO configurations. Simulating hundreds of interconnected DRA elements may require substantial computational resources and extended optimization time.

Machine Learning (ML) provides an effective approach to accelerate this design process. Deep Neural Networks (DNNs) can be trained using databases containing antenna geometries and their corresponding electromagnetic characteristics. Once trained, these surrogate models can rapidly predict parameters such as the S_{11} reflection coefficient, radiation patterns, and peak gain.

Furthermore, Genetic Algorithms (GA) and Particle Swarm Optimization (PSO) can be combined with ML models to efficiently explore large design spaces and identify optimized DRA geometries. Overall, integrating DRAs with advanced materials, met surfaces, graphene tuning, 3D fabrication, and ML-based optimization offers a promising pathway toward compact, high-gain, energy-efficient, and reconfigurable antenna arrays for future 6G networks.

Thin Films

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Thin films are extremely thin layers of material deposited on the surface of a substrate. Their thickness can range from a few nanometers to several micrometers. Despite their small thickness, thin films possess unique physical, chemical, electrical, optical, and mechanical properties. They are widely used in modern science, engineering, electronics, and various industrial applications.

Thin films can be prepared using different deposition techniques. Common methods include Physical Vapor Deposition (PVD), Chemical Vapor Deposition (CVD), sputtering, thermal evaporation, and sol-gel processes. The choice of technique depends on the type of material, required thickness, substrate, and desired properties of the film. Materials such as metals, semiconductors, ceramics, polymers, and oxides can be used to produce thin films.

Thin films play an important role in electronic devices. They are used in the manufacture of transistors, integrated circuits, solar cells, sensors, and display technologies. In solar panels, thin films help absorb sunlight and convert it into electrical energy. Thin-film coatings are also used on optical components to control reflection and transmission of light.

In addition, thin films improve the performance and durability of engineering materials. Protective coatings can increase resistance to corrosion, wear, oxidation, and high temperatures. Thin films are also used in medical implants, batteries, magnetic storage devices, and decorative coatings.

The study of thin films is important because their properties can be controlled by changing their thickness, composition, structure, and deposition conditions. With the rapid development of nanotechnology, thin-film research has become increasingly significant.

In conclusion, thin films are essential materials in modern technology. Their unique properties, versatile applications, and ability to enhance the performance of devices make them an important area of research and development. Continued advances in thin-film technology are expected to contribute to more efficient, durable, and innovative technological products.

AI-Enabled Semiconductor Design and Intelligent Automation

Dr. P.K. Pani
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Artificial Intelligence (AI) is increasingly reshaping the semiconductor industry by enabling intelligent approaches to the design, optimization, verification, and manufacturing of advanced integrated circuits. With the growing complexity of modern chips, conventional design methodologies often demand significant computational power, specialized expertise, and extensive development time. AI-enabled techniques help address these limitations by automating repetitive operations, exploring complex design possibilities, and generating optimized solutions.

AI technologies can be integrated across the Electronic Design Automation (EDA) workflow, covering areas such as architecture exploration, logic synthesis, floor planning, placement and routing, timing optimization, functional verification, and chip testing. Machine learning algorithms can process large amounts of historical and experimental design data to identify patterns, predict performance, and suggest suitable design configurations. For instance, AI-assisted placement and routing can efficiently organize billions of transistors and interconnections while optimizing key parameters such as power consumption, processing performance, and chip area (PPA).

A significant benefit of AI is its capability for automated design-space exploration. Semiconductor development involves evaluating numerous combinations of architectural and physical-design parameters to achieve an optimal result. Machine learning and reinforcement learning techniques can intelligently search these large design spaces, identify high-performing configurations, and reduce the number of costly design iterations. Consequently, development cycles can become faster and more resource-efficient.

Generalized-Integrator-Based PLLs for Robust Grid Synchronization of Renewable Energy Systems

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With the increasing penetration of renewable energy sources (RES) and grid-connected power electronic converters, accurate and fast grid synchronization has become essential for reliable power conversion, power quality, and stable grid operation. Phase-locked loops (PLLs) are widely employed to estimate the grid phase angle and frequency; however, conventional synchronization techniques can experience degraded performance under voltage disturbances such as harmonics, frequency variations, phase-angle jumps, voltage sags, interharmonics, and dc-offset components. My research focuses on the design and analysis of Generalized Integrator (GI)-based PLL structures for robust synchronization of three-phase grids integrated with renewable energy systems.

The work investigates and comparatively evaluates SOGI-, TOGI-, DSOGI-, DTOGI-, and modified/advanced GI-based PLL configurations using analytical modelling and MATLAB/Simulink simulations. Key performance indicators include settling time, phase-angle error, frequency estimation error, transient overshoot, harmonic rejection capability, and total harmonic distortion. Particular attention is given to challenging conditions involving two-phase voltage sag with 5th and 7th harmonics, dc-offset injection, phase jumps, frequency changes, and interharmonic disturbances. The comparative analysis indicates that different GI structures offer distinct advantages: DTOGI-based synchronization provides a promising balance between rapid dynamic response and harmonic attenuation, while DSOGI-based structures demonstrate strong performance during phase-angle disturbances. The study also highlights the limitations of existing structures under dc-offset conditions, motivating the development of improved adaptive filtering and control strategies.

A unified assessment framework is further considered to evaluate PLL performance across multiple disturbance conditions rather than relying on a single performance parameter. The proposed research contributes toward more robust synchronization strategies for renewable-energy-integrated grids and can support the reliable operation of grid-following converters. The present work is primarily analytical and simulation-based, providing a foundation for subsequent experimental and hardware-in-the-loop validation. Future extensions will focus on real-time implementation, controller optimization, and validation under practical grid operating conditions.

A Multi functional MoS₂/g-C₃N₅ 2D Hetero interface for Solar-Driven Ciprofloxacin Degradation, Oxygen Reduction, Oxygen Evolution Electrocatalysis, and Fluorescent Glyphosate Sensing



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The growing challenges associated with environmental pollution, sustainable energy generation, and rapid detection of hazardous contaminants have created an urgent need for multifunctional materials capable of performing diverse applications through a common platform. In this context, a two-dimensional (2D) MoS₂/g-C₃N₅ heterostructure was rationally designed to integrate photocatalytic, electrocatalytic, and fluorescence-sensing functionalities.

The MoS₂/g-C₃N₅ heterostructure was fabricated through an ultrasonic-assisted assembly strategy, enabling intimate interfacial contact between MoS₂ nanosheets and nitrogen-rich g-C₃N₅. Structural, morphological, optical, and electrochemical investigations confirmed successful heterostructure formation and efficient interfacial charge transfer. Among the investigated compositions, the optimized MC31 composite, containing MoS₂ and g-C₃N₅ in a 3:1 ratio, exhibited superior multifunctional performance. The enhanced activity was attributed to improved visible-light utilization, suppressed electron-hole recombination, and directional charge migration through the heterointerface. Under solar irradiation, MC31 achieved 92.5% degradation of ciprofloxacin, an environmentally persistent antibiotic, under optimized conditions. Reactive-species studies identified superoxide radicals as the dominant species responsible for pollutant degradation. The material also demonstrated efficient photocatalytic hydrogen peroxide generation, producing 3723.3 $\mu\text{M L}^{-1} \text{H}_2\text{O}_2$, highlighting its potential for sustainable oxidant production. Beyond photocatalysis, MC31 showed promising oxygen evolution electrocatalytic activity, requiring an overpotential of 327 mV to achieve a current density of 10 mA cm^{-2} . Furthermore, its fluorescence response enabled sensitive detection of glyphosate, achieving 86.14% fluorescence quenching, a Stern-Volmer constant of $8.6 \times 10^4 \text{ M}^{-1}$, and a detection limit of 0.987 ppm. Overall, this work demonstrates that interfacial engineering of 2D MoS₂/g-C₃N₅ can provide a versatile material platform for environmental remediation, sustainable chemical production, energy conversion, and pollutant monitoring 1,2,11–15,3–10 .

AI-Driven Transformation of Software Development

By Rudranarayan Sethi

Branch -B-Tech, Department-CSE, Year-2nd

Artificial Intelligence (AI) is no longer a futuristic concept, it has become a powerful tool that is reshaping modern software development. From writing code to maintaining complex systems, AI is changing how developers build, test, and deliver applications. Instead of replacing human programmers, AI acts as a smart assistant that improves accuracy, reduces errors, and saves valuable time.

One of the most practical uses of AI can be seen in automated code generation. For example, tools like GitHub Copilot suggest lines of code based on a developer's intent, making programming faster and less error-prone. Similarly, ChatGPT-based assistants are helping developers understand problems and design solutions in real-time. This allows programmers to focus more on creativity and problem-solving rather than repetitive tasks.

AI has also transformed software testing and debugging. In the past, developers manually created test cases and spent hours finding bugs. Today, companies use AI-powered testing platforms that automatically detect vulnerabilities and suggest fixes. For instance, Infosys and TCS in India are already adopting AI-driven quality assurance tools to improve the reliability of their software products.

Another important impact of AI is in cybersecurity. With the rise of digital banking and online services, security threats are becoming more advanced. AI algorithms now monitor network behavior, detect unusual activities, and prevent attacks in real time. A practical example is how Microsoft Defender uses machine learning to identify and block malware more effectively than traditional methods.

AI is also helping in project management and user experience. Predictive analytics tools can forecast deadlines, allocate resources, and highlight potential risks in large projects. On the user side, AI-powered chatbots like Siri, Alexa, and Google Assistant are integrated into mobile apps, making customer interactions smoother and more intelligent.

In conclusion, Artificial Intelligence is not just supporting modern software development. It is driving it forward. With applications in coding, testing, cybersecurity, and project management, AI ensures faster, smarter, and more secure software solutions. As the technology continues to advance, developers who embrace AI will not only save time but also create innovative applications that can solve real-world problems more effectively.

CYBERSECURITY

Securing the Digital World

Rudra Mohapatra

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In today's digital era, almost every part of our life – banking, shopping, communication, and even healthcare – depends on the internet. This makes cybersecurity extremely important. Cybersecurity means protecting computers, networks, and data from attacks or unauthorized access. It ensures that information stays safe, private, and available whenever needed.

The importance of cybersecurity cannot be overstated. Cyberattacks can cause massive financial losses, damage reputations, and even threaten national security. Businesses risk



losing customer trust and years of credibility from a single data breach. Individuals, too, face dangers like identity theft and online fraud if proper precaution are not taken.

Some common cyber threats include phishing emails, malware infections, denial-of-service attacks, insider misuse, and data breaches. With the rise of cloud storage, smart phones, and artificial intelligence, the attack surface is growing every day.

To stay safe, multiple security layers are essential. Using firewalls, anti-virus software, strong passwords, and multi-factor authentication can help reduce risks. Regular software updates and user awareness training are equally important since most attacks happen due to human error.

Looking ahead, cybersecurity will only become more crucial with advancements like AI and quantum computing. Building a culture of awareness and vigilance is key to protecting our digital future.



Research & Achievement Spotlight

THE MAGIC OF SCIENCE

“WHAT IF THE GREATEST MAGIC IN THE WORLD IS NOT PERFORMED BY A MAGICIAN, BUT DISCOVERED BY A SCIENTIST...?”

ना कोई जादू की छड़ी, ना कोई तिलिस्म का राज़,
साइंस ने बदल दिया दुनिया का अंदाज़।
जो कल था सपने, आज हकीकत बन गया,
इंसान के इल्म ने हर नामुमकिन को मुमकिन कर दिया।



SHIVAM DAS
B.Tech 2nd Year CSE

What if the sun suddenly disappeared and the world become completely dark? what if we had no electricity, no internet, no smart phones , and no modern medicines? Life as we know it would almost come to a standstill. Science is the invisible force behind much of our modern world, it explains the mysteries of nature, turns ideas into innovation & transform the impossible into reality. From the tiny microchip inside a smart phone to Spacecraft exploring distant planets. science Continuously change the way we live, think, communicate and discover. It is not really only a subject in a classroom - it is the foundation of modern civilization and one of humanity greatest tools for shaping the future. our daily lives are deeply connected with science.

Science is not only the systematic study of natural world through observation, but also the real life validation and it tell us how the universe works. Science is not limited to laboratories it exist everywhere .

From star that shine in endless space,
To tiny cells we cannot trace,
Science reveals what eyes can't see,
And turn our dream to reality.

Electric lights that chase the night,
Satellites flying beyond our sight,
Robots that learn, machines that think,
Science Connects the world in a blink.

From gravity to galaxies wide,
There are countless wonders yet to find.
With every questions, every new start,
Science awakens the curious heart.

No wand, no spell, no magic art--
Just human knowledge, & mind and heart
The greatest magic we can see.
Is the endless world of SCIENCE!

The modern era has brought science into almost every aspect of human life. it teaches us to question rather than blindly accept. why does the earth revolve around the sun? How does the human brain create thoughts? what lies beyond the observable universe? can machines become Intelligent ? Each question opens the door to another mystery science reminds us that the universe is filled with wonder waiting to be understood and it is a greatest MAGIC:- THE MORE WE DISCOVER, THE MORE THERE IS TO WONDER ABOUT,

GRID-FORMING INVERTERS: ENABLING THE FUTURE OF RENEWABLE POWER SYSTEMS

Prof. Kumaresh Rout
Associate Professor (EEE Department)
Associate Dean (Examination)



The increasing integration of solar photovoltaic and wind energy is transforming conventional power systems from synchronous-generator-dominated networks into inverter

dominated grids. Conventional synchronous generators naturally provide inertia, voltage support, and frequency regulation, whereas most renewable energy sources are interfaced through power electronic converters. This transition creates challenges in maintaining grid stability, particularly during disturbances and low-inertia conditions. Grid-forming (GFM) inverters have emerged as a promising technology to address these challenges. Unlike conventional grid-following inverters that rely on a phase-locked loop (PLL) to track the grid voltage, GFM inverters can establish their own voltage magnitude, phase angle, and frequency. Control techniques such as virtual synchronous machine control, droop control, and virtual oscillator control enable these converters to emulate selected characteristics of synchronous machines while providing fast dynamic responses.

GFM technology has significant potential for improving frequency stability, voltage regulation, and transient performance in renewable-rich power systems and microgrids. During disturbances, GFM inverters can rapidly modify active and reactive power output and contribute to grid-forming and grid-supporting functions. Their implementation, however, involves challenging issues such as current limiting, protection coordination, controller interaction, stability analysis, and operation under weak-grid conditions. Advanced control strategies, digital real-time simulation, and wide-bandgap semiconductor devices are expected to further enhance GFM performance. Future power networks may contain a large proportion of converter-based generation, making coordinated control between GFM and grid-following converters increasingly important. Therefore, grid-forming inverter technology represents a significant development in power electronics and power-system control, providing a technical pathway toward stable, resilient, and highly renewable electrical grids.

A CYBER FRAMEWORK FOR SCIENTIFIC COMPUTATION

A number of initiatives have been launched to create the infrastructure needed to support the vision of next-generation research environments. These include the development of collaboratories, computing grids, e-science platforms, and various domain-specific projects aimed at building a new cyberinfrastructure. Collectively, such efforts are driving a paradigm shift in how scientific research is conducted, how data is accessed, and how collaborations are facilitated. The rapid growth of the Internet and the World Wide Web has dramatically transformed research practices, making secure and efficient access to remote computing resources more critical than ever.

For many computationally intensive tasks, these resources are not limited to a single computer but consist of distributed systems connected through grid networks such as the TeraGrid. Similarly, data-heavy research often relies on distributed databases located across multiple remote servers. Most computational servers operate on Unix-based systems, and users typically connect through secure shell (SSH) sessions, opening X-windows to run commands directly on remote servers. Users might access multiple servers simultaneously, maintaining accounts and personal directories on each. However, while visualization can be enabled through X11 forwarding, this protocol struggles with graphics rendering, requires substantial bandwidth, and is highly dependent on a stable network connection. Any interruption can cause the session to fail, making the experience unreliable for sustained scientific work.

The development of Web-services technologies has introduced new models for accessing data and computational resources remotely. From the mid-1990s onward, computer scientists explored Web-service-based approaches for scientific simulations. Although initial progress was slow due to limited real-world applications, interest in these technologies has recently resurged, particularly when combined with distributed computing grids. Within molecular science, for instance, several major projects such as CMCS, GEMSTONE, GridChem, Discovery Net, CombeChem, Reality Grid, and the Virtual Laboratory Project have applied Web-services architectures to enable collaborative, Web-based simulation environments.

In these frameworks, users interact with thin clients that communicate directly with Web-service applications rather than the server's operating system. Authentication and resource requests are handled by the Web application itself, and users typically work with Web accounts and virtual directories instead of owning actual server accounts. This setup is particularly suited for researchers who only require results—without concern for the underlying computational processes or direct interaction with the server environment.

Web-services technology has had its greatest impact in the rise of collaboratories—Web-based collaborative environments where distributed teams can share tools, data, and instruments while jointly addressing complex research challenges. Collaboratories generally fall into two categories: data-sharing focused or remote-instrument access focused. Examples

include the Research Collaboratory for Structural Bioinformatics, which provides access to biological databases and analysis tools; the Space Physics and Aeronomy Research Collaboratory, which integrates Internet-based access to space science instrumentation in Greenland; the Materials Microcharacterization Collaboratory, enabling remote electron-beam microcharacterization of materials; and the Environmental Molecular Science Collaboratory, which allows remote operation of NMR and FTICR spectrometers at the Pacific Northwest National Laboratory.

Although SSH-based systems are effective for individual computational tasks and Web-services excel in collaborative scenarios, no single platform has yet integrated both functionalities seamlessly. As a result, researchers must juggle multiple disjointed systems, often facing inefficiencies, technical complexity, unstable network-dependent setups, and high bandwidth demands for visualization tasks. Collaboration is further complicated since existing collaborative platforms operate within fundamentally different software architectures.

To address this, we are developing Computational Science and Engineering Online (CSE-Online), an extendable Web-accessible simulation environment designed to unify these paradigms. CSE-Online enables users to simultaneously access diverse applications, datasets, and computing resources hosted on distributed servers through a single secure and transparent virtual desktop. Its innovation lies in supporting both individual and collaborative research within the same framework. The paper proceeds by outlining the architecture of CSE-Online and then detailing its four main components: knowledge management, visualization and analysis, communication and collaboration, and the computing environment. Discussion also includes the design principles and underlying technologies used for implementation.



Closing Notes

As we arrive at the close of this edition, we pause to express our heartfelt gratitude to everyone whose dedication, creativity, and enthusiasm have brought these pages to life. This publication is more than a collection of articles and ideas; it is a reflection of collective effort, shared curiosity, and a deep commitment to learning and innovation.

We extend our sincere appreciation to the Editorial Board, whose unwavering commitment has been instrumental in shaping this edition. Their meticulous efforts in curating, reviewing, refining, and presenting the content have ensured that every contribution reflects quality, clarity, and purpose. Their thoughtful guidance, attention to detail, and spirit of collaboration have transformed a diverse range of ideas into a coherent and meaningful publication.

Our heartfelt thanks also go to all our contributors—faculty members, researchers, and students—who have generously shared their knowledge, creativity, experiences, and scholarly insights. Each contribution has added a distinctive voice to this edition, enriching its pages with fresh perspectives and inspiring our readers to look beyond the familiar, question the known, and explore the possibilities that lie ahead.

We are equally grateful to our readers, whose continued interest, encouragement, and support give meaning to our efforts. Your engagement inspires us to continually raise the bar and create content that informs, stimulates thought, and celebrates the vibrant intellectual spirit of our community.

As we celebrate the successful release of this edition, we are delighted to open the doors for submissions to our upcoming edition. Our publication continues to be a vibrant platform where ideas meet imagination, knowledge meets creativity, and diverse voices come together to create meaningful conversations.

We warmly invite submissions from faculty members, researchers, and students. We welcome original research, critical reflections, innovative ideas, scholarly perspectives, and creative expressions. Contributions may include research papers, articles, case studies, review papers, interviews, opinion pieces, and insightful commentaries addressing contemporary issues, emerging technologies, interdisciplinary themes, or subjects that encourage deeper thought and discussion.

We also invite creative contributions such as essays, poetry, artwork, and other forms of creative expression. These voices bring colour, emotion, and imagination to our publication, reminding us that knowledge is not confined to a single discipline or form of expression.

Our vision is to create a space where every thoughtful idea has the opportunity to be heard, every meaningful perspective can find an audience, and every contribution can inspire further exploration. We encourage contributors to approach their submissions with originality, clarity, creativity, and a spirit of inquiry. All submissions will undergo an editorial review to maintain the quality, coherence, relevance, and vision of the publication.

We invite you to become a part of this continuing journey—a journey that celebrates our collective achievements while nurturing the ideas that will shape our future. Your voice, your ideas, and your creativity can help make the next edition richer, more engaging, and more inspiring.

*Thank
you!*