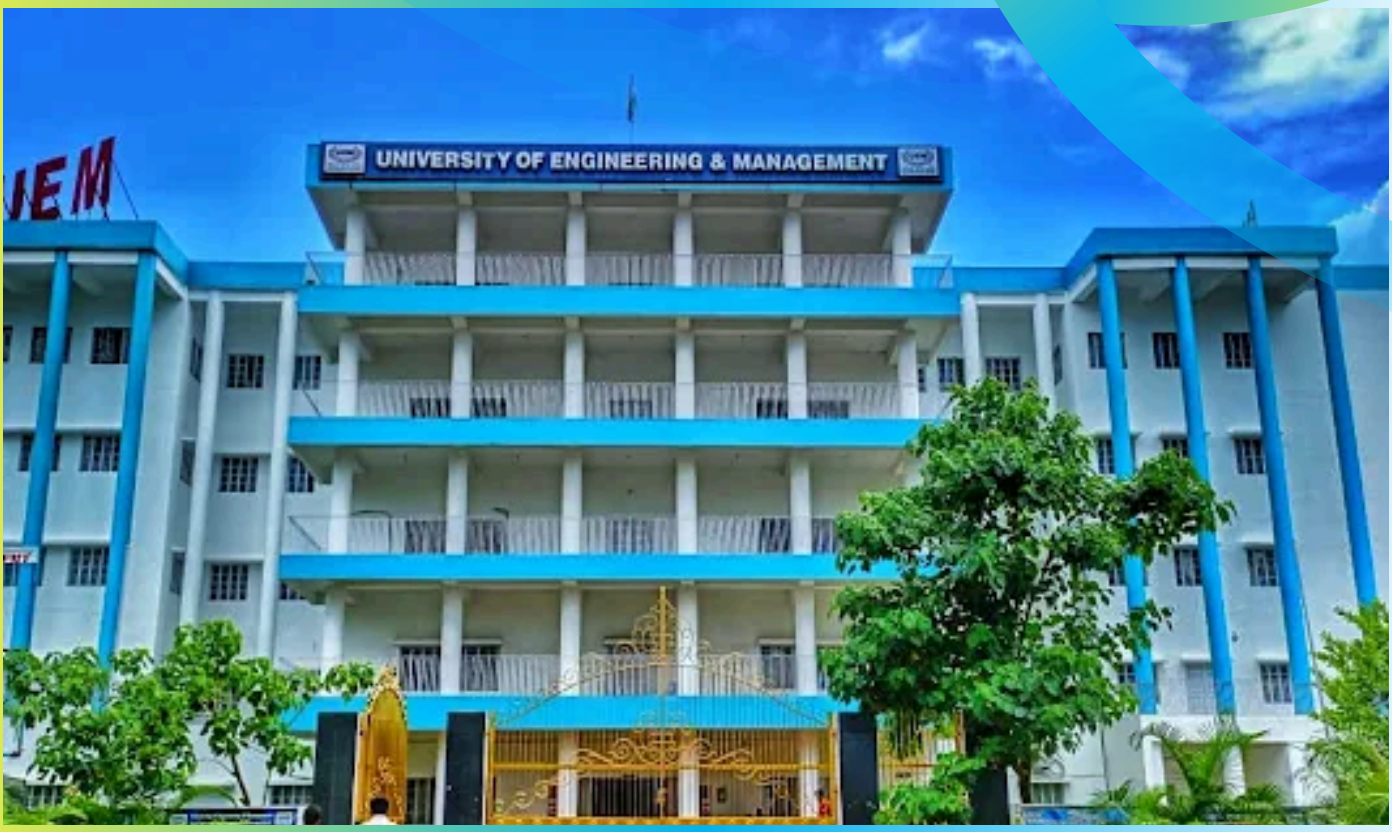



# UEMGREEN 2026

## 7th International Conference on Green Computing

## 3rd – 4th April, 2026

## Organized

## by

## Department of ECE, CSE(IOT), Ph.D Cell of University of Engineering & Management, Kolkata

# MESSAGE FROM THE DESK OF CHANCELLOR, UEM KOLKATA

## PROF. BANANI CHAKRABARTI

University of Engineering & Management, Kolkata, University of IEM Group has taken an ambitious program to organize an International Conference on Green computing from 3rd to 4th April 2026 at IIT, Kharagpur Research Park. In additional to numerous achievements of the University this is yet another milestone in our academic pursuit. A mix of plenary talks and paper presentations will also be there in the Conference.

I hope two days deliberations and interactions amongst experts and participants will be immensely helpful for the entire fraternity and will emerge many meaningful outcomes. On this occasion, I convey my good wishes to the entire team for the relentless endeavor in making the Conference a true success.

# MESSAGE FROM THE DESK OF VICE CHANCELLOR, UEM KOLKATA

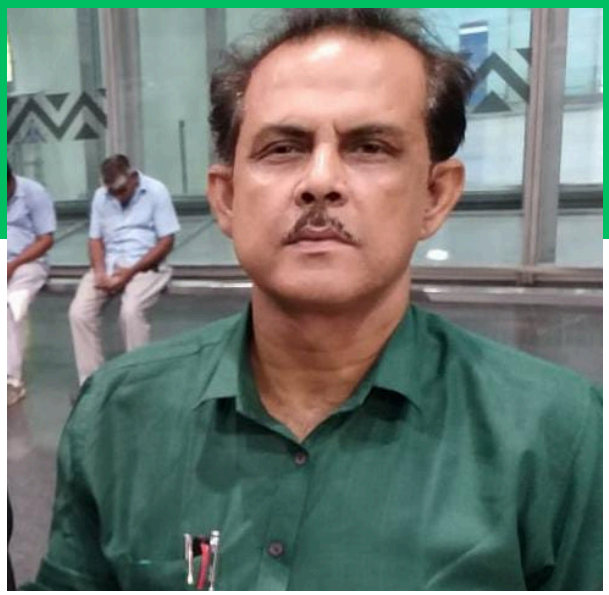
## PROF. (DR.) SATYAJIT CHAKRABARTI

It is my great pleasure to know that an International Conference on UEMGREEN 2026 will be organized at the University of Engineering and Management, Kolkata on 3rd and 4th April 2026. The Conference aims at bringing the advancement in the field of Green Computing, Cloud Computing, Bioinformatics and Quantum Computing. It lays a special emphasis at educating and informing researchers and industry professionals on the latest development of technology.

The Concept of Energy Management is becoming an enormous issue in modern society. So, special emphasis shall be taken for educating the people in Green Computing and its allied research and also industry professionals at the latest knowledge of technology. I am extremely glad as because the Conference theme is of the same. I thank you, the participants, for enriching the Conference by your presence. I hope you will enjoy the content, renew old friendships, make new friends, get new ideas and above all have a good time.

I warmly welcome you to the 7$^{th}$ International Conference on Green Computing- UEMGREEN 2026 and wish it to be a grand success.

# MESSAGE FROM THE DESK OF CONVENER, UEM KOLKATA



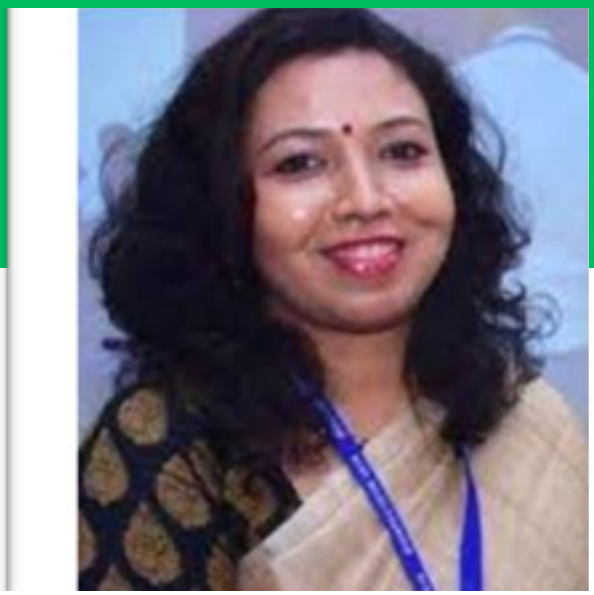
## PROF. (DR.) ABIR CHATTOPADHYAY

I welcome all the participants of UEMGREEN 2026. The main goal of organizing this Conference is to share and enhance the knowledge of each and every individual in this environment world. We have given a good opportunity for those who have a thirst in knowing the present technological developments and also share their ideas. Furthermore, this Conference will also facilitate the participants to express and share various novel ideas.

The Conference aims to bridge the Research Works in academic and other professional trainings, research presentations and other professional trainings, research presentations and keynote address in current technological trade. It reflects the growing importance of Energy Management for Green Computing. It is the study and practice of using computing resources efficiently by designing.

I thank the Conference Committee for extending their valuable time in organizing the program and to all the authors, reviewers and other contributors.

# MESSAGE FROM THE DESK OF DEAN (IQAC), UEM KOLKATA



## PROF. (DR.) RAJASHREE PAUL

I welcome all the participants of UEMGREEN 2026. The main goal of organizing this Conference is to share and enhance the knowledge of each and every individual in this environment Energy Management for Green Environment world. Furthermore, this Conference will also facilitate the participants to express and share various novel ideas. I convey my good wishes to the Conference Committee members and their belief in the excellence of UEMGREEN 2026.

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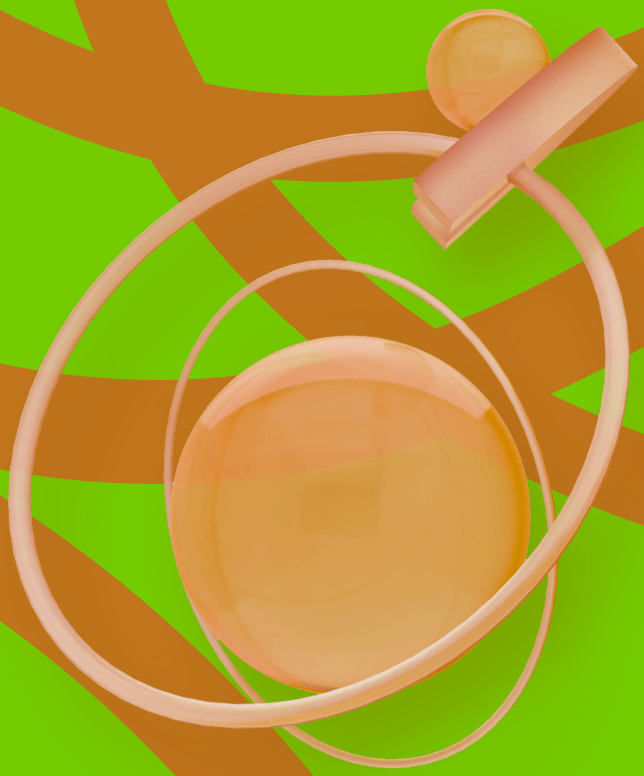


# 01
# Biography of Chief Guest and Speakers

# PROF. (DR.) KALLOL PAUL, VICE CHANCELLOR, KALYANI UNIVERSITY

Dr. Kallol Paul completed his PhD awarded from Jadavpur University in the year of 1999. He completed his Masters of Science at Jadavpur University in 1990.He is a senate member of NIT, Raipur. Currently, he is serving as the Vice Chancellor of Kalyani University.

# PROF. DR. N RAMAKRISHNAN (MONASH UNIVERSITY)

Narayanan Ramakrishnan is currently a Professor in the Electrical and Robotics Engineering, School of Engineering, Monash University Malaysia. He is also leading Micro and Nano Devices Research Lab. His current research interest includes acoustic wave sensors and 2D materials for detecting gases, VOCs, and other environmental conditions. His interest also includes developing prototypes of microfabrication tools and handheld sensor systems. He has filed six patents from Monash on semiconductor fabrication tools/ Sensors and some licensed /commercialized jointly with industries. He has received more than 15 external grants from Government of Malaysia and Industry as Principle Investigator. Over the last 13 years of his academic career at Monash, he has graduated 10 PhD students and supervising 5 Ph.D students as main supervisor. He is also the chair for innovation and industry engagement for School of Engineering creating translation research culture among his peers.

# PROF. DR. ARNAB MUKHERJEE (IISER PUNE)

Arnab Mukherjee did his BSc from Jadavpur university, Kolkata in 1998. He then joined Indian Institute of Science, Bangalore as an integrated PhD student in chemical sciences. He completed his PhD from S. S. C. U. department of IISc Bangalore in 2005 under the supervision of Professor Biman Bagchi. Dr. Mukherjee then went for his postdoctoral research in Ecole Normale Superierure, Paris, France from 2005 to 2007 and then to University of Colorado, Boulder from 2007 to 2009. He joined IISER Pune as an assistant professor in November, 2009. He became associate professor in 2015 and full professor in 2021.

# PROF. DR. DEBANGSHU DEY (JADAVPUR UNIVERSITY, IEEE KOLKATA)

Dr. Debangshu Dey received his B.E.E, M.E.E. and Ph.D. degrees from Jadavpur University, Kolkata, India in 2003, 2005 and 2009, respectively. Presently he is working as a Professor in the Electrical Engineering Department, Jadavpur University, Kolkata, India. Dr. Dey has published more than 125 research papers in International journals and conferences in the fields of his research including 31 papers in IEEE Transactions and co-authored 2 books from Springer-Verlag London and Elsevier also edited 2 volumes published by IEEE. He is the Principal Investigator of 3 Government funded projects. 6 patents have been granted to him, of which 1 is a US Patent. He is the recipient of IEI Young Engineer Award in 2014, TARE research associateship from SERB, Govt. of India in 2018, VisvesaryaYoung Faculty Research Fellowship in 2019, Outstanding Chapter Engineer Award by IEEE PES, Kolkata and two best paper awards. He was the visiting researcher/visiting faculty member/ research collaborator in various institutes like University of Applied Sciences, Augsburg, Germany and ISI, Kolkata. He is the Associate Fellow of Indian National Science Academy-INSA. His areas of interest are applications of signal and image conditioning and processing tools in electrical and bio-medical systems, condition monitoring of electrical equipment, non-invasive testing related to condition assessment. Dr. Dey was in-charge of Measurements and Instrumentation Laboratory, Jadavpur University, former Secretary of IEEE Kolkata Section and currently the Chair of IEEE Signal Processing Society, Kolkata and former Chair of IEEE PES Kolkata.

# PROF. DR. ANJAN BARMAN (S. N. BOSE NATIONAL CENTRE FOR BASIC SCIENCES)

Prof. Barman obtained Ph.D. in Materials Science from IACS (Jadavpur University) in 1999. He worked as postdoctoral fellow at Technion, Israel, University of Exeter, UK, University of Leeds, UK and University of California Santa Cruz between 1999 and 2006. He worked as a faculty member at University of South Carolina and IIT Delhi between 2006 and 2009 before joining S. N. Bose National Centre for Basic Sciences in 2009. His present interest is in Magnonics and Spintronics, including experimental and simulation studies of high frequency magnetization dynamics in magnetic thin films, multilayers, nanowires, nanoparticles and patterned nanostructures.

# PROF. DR. ASHOKE SUTRADHAR (IIEST, SHIBPUR)

Prof. Dr. Ashoke Sutradhar is a Professor in the Department of Electrical Engineering at IIEST, Shibpur, with expertise in control systems, instrumentation, and neural networks. He holds a Ph.D. from B.E. College (D.U.) and has been serving as a professor since 1989, specializing in adaptive control and modeling, particularly in biomedical applications.

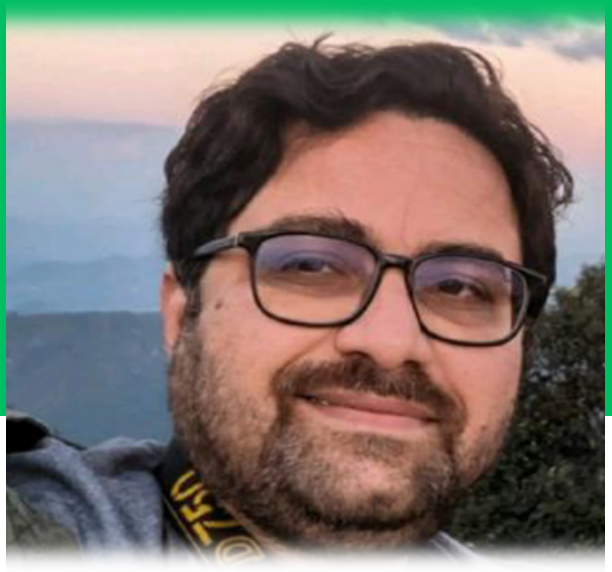
Key Biodata and Academic Details:

- Designation: Professor, Department of Electrical Engineering, IIEST, Shibpur.
- Education: Ph.D. (B.E. College - 2003), M.E.E. (Jadavpur University - 1985), B.E.E (Jadavpur University - 1983).
- Research Areas: Control Systems, Instrumentation, Artificial Neural Networks, MEMS, Embedded Systems.
- Experience: Professor at IIEST, Shibpur, since 1989.
- Awards: Recipient of the Pandit Madan Mohan Malaviya Memorial Gold Medal (1988-89) and The Corps of Electrical and Mechanical Engineers Prize (1989-90) from the Institution of Engineers (India).
- Key Publications: Focus on adaptive controllers, glucose-insulin interaction, and MEMS.

# PROF. DR. J AJAYAN (SR UNIVERSITY)

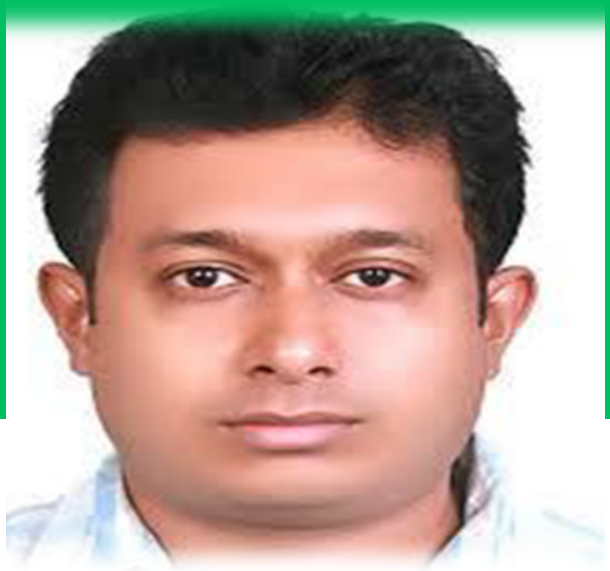
Dr. J. Ajayan received his B.Tech Degree in Electronics and Communication Engineering from Kerala University in 2009, M.Tech and Ph.D. Degree in Electronics and Communication Engineering from Karunya University, Coimbatore, INDIA, in 2012 and 2017 respectively. He is an Associate Professor in the department of Electronics and Communication Engineering at SR University, Telangana, India. He has published more than 100 research articles in various journals (Elsevier, Taylor and Francis, Springer, IOP Science, Wiley) and international conferences. He has published one book, more than 10 book chapters, and 2 patents. He is a reviewer of more than 30 journals in various publishers which includes IEEE, IET, Elsevier and Springer journals. He is a Guest Editor – Special Issue on P2P Computing for Beyond 5G Network (B5G) and Internet-of-Everything (IoE) by Peer-to-Peer Networking and Applications, Springer and Special Issue on Energy Harvesting Devices, Circuits and Systems for Internet of Things by Microelectronics Journal, Elsevier. He has served more than 10 conferences as technical advisory/reviewer committee. His areas of interest are microelectronics, semiconductor devices, nanotechnology, RF integrated circuits and photovoltaics.

# PROF. DR. ARIJIT MUKHERJEE (TCS RESEARCH)



Arijit is a Principal Scientist at TCS Research, where he leads the Edge & Neuromorphic Computing group. With a PhD in Grid Computing, he brings a strong foundation in distributed systems to his research. Prior to joining TCS, he contributed to the development of early grid and cloud computing concepts, including work on foundational web service standards. His current research focuses on advancing edge computing paradigms, exploring low-power, low-latency solutions, and leveraging brain-inspired neuromorphic architectures for intelligent edge devices. Beyond research. he is a passionate photographer with international recognition, a skilled violinist, and an avid reader of history.

# PROF. DR. ARIJIT UKIL (TCS RESEARCH)



Arijit Ukil (TCS Research) is having more than 22 years of research experience in different capacities. He is working as Principal Scientist in TCS Research, Tata Consultancy Services, India with expertise in the areas of LLM optimization. Previously, he worked as Scientist-C in the Defence Research and Development Organization (DRDO), India. He has published more than 60 research papers in distinguished conferences and journals. He has filed more than 50 patents with 40+ patent grants in different geographies. He holds PhD (Cum Laude) from University of Murcia, Spain. He is a Senior Member, IEEE. He served as the general chair in KDAH workshop of ACM CIKM and ICASSP 2024 workshop of Deep Neural Network Model Compression. He has presented number of tutorials in different venues including invited talks in University of Hertfordshire, UK, University of Glasgow, UK, ICASSP, tinyML Forum, CODS-COMAD, ACM SAC.

# MR. SUMAN DAS, IBM

Mr. Suman Das is currently working in Digital Transformation at IBM. He has completed his studies from Indian institute of management, Calcutta.
He is a Certified Independant Director (MCA, Govt. of India).

# MR. SAPTASWA SARKAR
# AIR ASIA

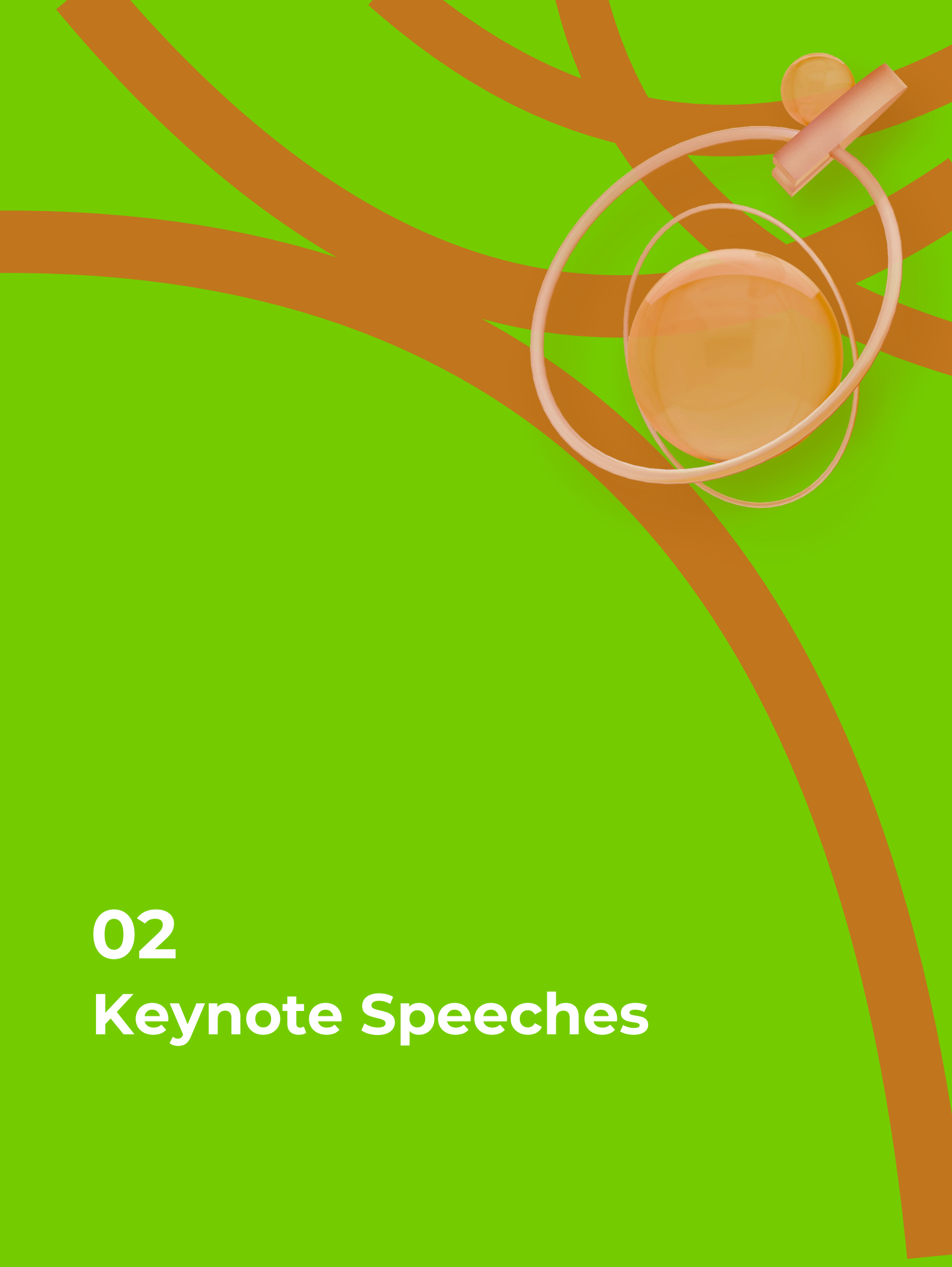
Saptaswa Sarkar, based in Kolkata, is currently a Product Engineering Manager - Blockchain at airasia Super App. Saptaswa Sarkar brings experience from previous roles at IBM India Private Limited, Hewlett-Packard, Veloze Global and Global IDs. Saptaswa Sarkar holds a 1999 - 2002 B Level ( MCA) in Computer Science and Application @ DOEACC. With a robust skill set that includes XML, Web Services, Agile Methodologies, Requirements Analysis, Software Development and more.

# PROF. K SEKAR (IISC, BANGALORE)

Prof. Kanagaraj Sekar is a leader of Laboratory for Structural Biology and Bio-computing and professor of Department of Computational and Data Sciences in Indian Institute of Science, Bangalore. He is a member of the National Academy of Sciences; Member in American Crystallographic Association; Member, CODATA National Committee. He is also a life member in Indian Crystallographic Association; Life member in Indian Biophysical Society; Life member in Society of Biological Chemists.

# PROF. G UMA DEVI (UEM JAIPUR)

Dr. G Uma Devi is currently working in UEM, Jaipur. Her research fields include Machine Learning, Cloud Computing, Big data and Data mining.



# 02
# Keynote Speeches

# Toward Next Generation Green Electronics: A Perspective on Organic Semiconductor Devices

**Dr. J. AJAYAN**
**SR University**

The rapid expansion of electronic technologies has significantly increased energy consumption, electronic waste, and environmental impact, demanding the development of sustainable and eco-friendly alternatives. Organic semiconductor devices have emerged as promising candidates for next generation green electronics due to their low-temperature processing, mechanical flexibility, lightweight nature, and compatibility with large-area fabrication techniques. This session presents a comprehensive perspective on the role of organic semiconductor materials in enabling environmentally responsible electronic systems. Organic semiconductors, including small molecules and conjugated polymers, offer unique advantages such as solution processability, reduced material wastage, and compatibility with printing technologies. These features enable low-cost, scalable manufacturing on flexible and biodegradable substrates, thereby reducing carbon footprint compared to conventional inorganic semiconductor technologies. The discussion will highlight recent advances in organic field-effect transistors (OFETs), organic photovoltaics (OPVs), and organic light-emitting diodes (OLEDs), emphasizing material innovation, device engineering strategies, and performance optimization.

Particular focus will be given to improving charge carrier mobility, operational stability, and environmental robustness, which remain critical challenges for large-scale adoption. Strategies such as molecular design optimization, interface engineering, dielectric selection, and encapsulation techniques will be addressed. Furthermore, the integration of organic devices into wearable electronics, smart packaging, bio-integrated sensors, and energy-harvesting systems will be explored as pathways toward sustainable and circular electronic ecosystems.

The session aims to provide insights into how organic semiconductor technologies can bridge the gap between high-performance electronics and environmental sustainability. By aligning material innovation with green manufacturing principles, organic semiconductor devices hold significant potential to transform the future landscape of electronics toward energy efficiency, recyclability, and reduced ecological impact.

# A data mining study: Sequence motifs in genome sequences and invariant water molecules in three-dimensional protein structures

**K. Sekar**
**Department of Computational and Data Sciences**
**Indian Institute of Science**
**Bangalore - 560 012**
**India**

Internal sequence repeats in protein sequences are incredibly important for understanding the relationship between amino acid sequences and their three-dimensional structures. These repeats play a vital role in protein-protein interactions and in binding to other ligands such as DNA and RNA. Further, they have been extensively used to understand genome function and to predict protein structure. Therefore, tracking sequence repeats is essential to better understand their evolutionary and functional roles. Additionally, a data mining study has been conducted to identify invariant water molecules in bovine pancreatic Phospholipase A2 structures. The study of internal sequence repeats and invariant water molecules could be highly valuable for scientists working in the fields of structural biology, genomics, and proteomics.

# The Future of Data-Driven Innovation through Big Data Analytics

**Dr. G. Uma**
**UEM, Jaipur**

The rapid growth of digital technologies has led to an unprecedented increase in data generation across various sectors. Big Data Analytics has emerged as a powerful approach to process, analyze, and extract valuable insights from large and complex datasets. By integrating advanced technologies such as artificial intelligence, machine learning, and cloud computing, organizations are able to transform raw data into strategic knowledge. This keynote discusses how data-driven innovation is reshaping industries including healthcare, finance, smart cities, and business intelligence. It highlights the role of modern big data frameworks such as Hadoop and Spark in enabling scalable and efficient data processing. The talk will also explore predictive analytics and real-time data processing for improved decision-making. Key challenges related to data privacy, security, and ethical use of data will be addressed. Furthermore, emerging trends such as edge analytics and automated data intelligence will be examined. The session aims to provide insights into how big data analytics can drive innovation and competitive advantage. It encourages researchers and practitioners to explore new methodologies for managing and utilizing large-scale data effectively.

**Suggested Keywords:**
**Big Data Analytics, Data-Driven Innovation, Machine Learning, Predictive Analytics, Cloud Computing, Digital Transformation.**

# Computing Within Planetary Limits: New Architectures, New Memory, and New Ways to Communicate

**Dr. Arijit Mukherjee**
**Principal Scientist, TCS Research**

The exponential growth of data, AI, and connected devices has pushed computing to a point where energy, materials, and sustainability, not transistor scaling, are the dominant constraints. This talk argues that energy is the new Moore's Law. Drawing on insights from the Decadal Plan for Semiconductors, it reframes green computing as a system-level challenge spanning sensing, memory, communication, and architecture. The talk highlights why data movement now costs more than computation, and why new paradigms, such as sensing-to-action, compute-near-memory, and edge intelligence are essential to build a sustainable digital future without limiting innovation.

# Gen AI at Industry: From Cloud to Edge

**Dr. Arijit Ukil**
**Principal Scientist, TCS Research**

Information dynamics are shifting, from static “documents” to streaming “digital exhaust.” This talk argues that GenAI becomes industrially useful and scalable only when grounded in sensors: turning multimodal sensors (Electrocardiogram, vibration, vision, audio, clinical notes, etc.) into actionable insights, knowledge management, and closed-loop decisions with optimized consumption of resources including computing, memory, and energy. While cloud foundation models are good for global reasoning, but edge-resident, compressed models perform real-time inference, sovereign data residency, and energy-aware computing. This talk outlines the architectural overhaul and technologies for human-centric applications, rooted in signal and information processing that decouple intelligence from centralized clouds; adopt efficient, decentralized AI, edge-native GenAI and Small Language Models (SLMs), learning locally from multimodal signals with edge-resident agents. Use cases span smart manufacturing and Industrial IoT (predictive maintenance, quality inspection), retail (loss prevention, demand signals), and healthcare (triage assist, documentation), etc. From signals to contextual intelligence, from cloud to edge, secure, personalized, and low-latency AI is reshaping how information becomes knowledge and action by enabling data sovereignty and maximizing the energy-intelligence economics.

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# A concise exploration of how sustainability and Green IT practices can reduce environmental impact while driving innovation across industries

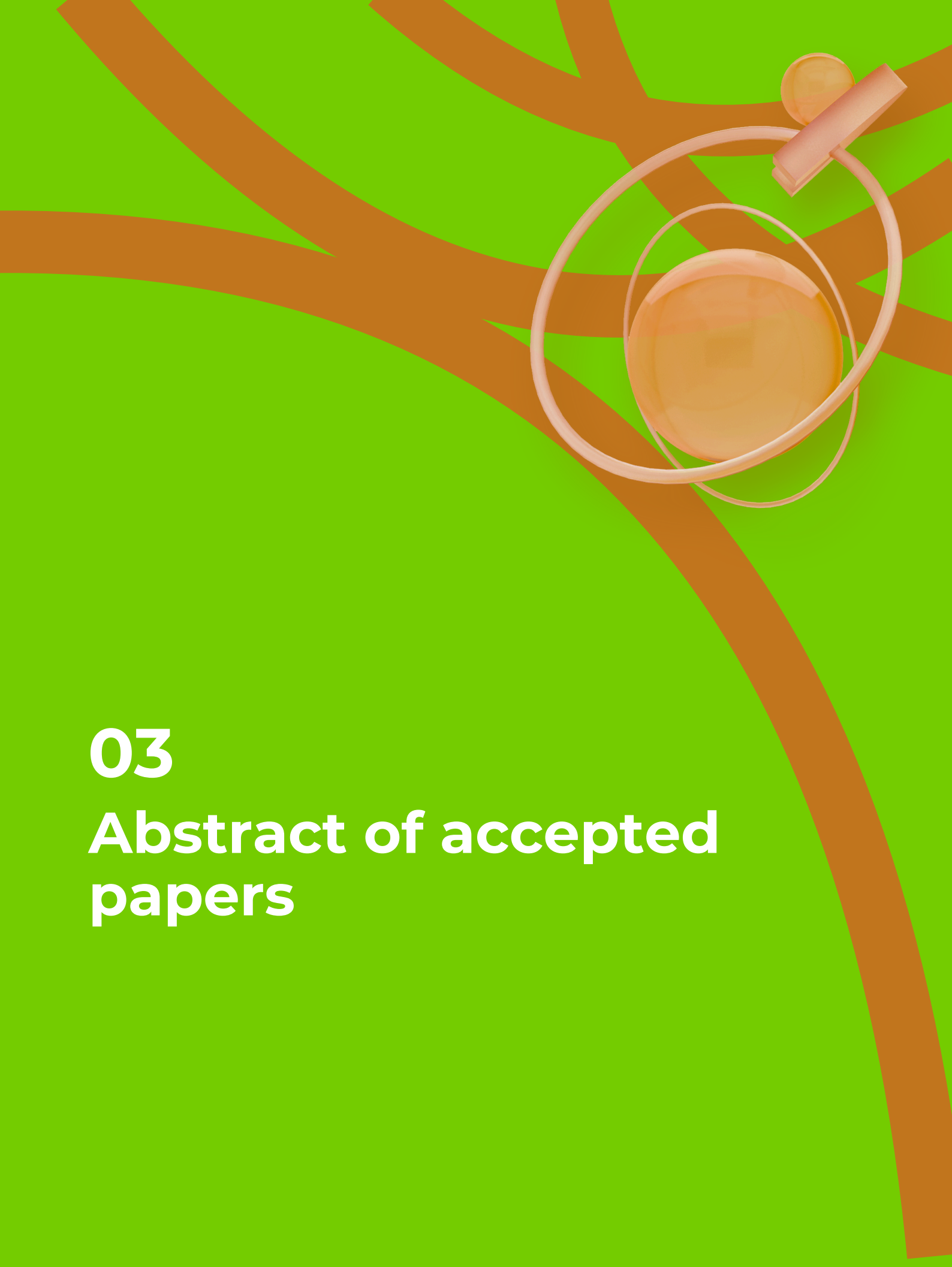
**Mr. Suman Das**
**IBM**

This session explores the rapidly growing importance of Sustainability and Green IT, highlighting how environmental responsibility is becoming a core driver of innovation, business value, and societal impact. The talk introduces the fundamentals of sustainability and ESG, examines the global forces accelerating climate action, and demonstrates how enterprises are adopting sustainable practices across technology, operations, and supply chains. It further outlines the role of Green IT, including carbon-aware platforms, energy-efficient infrastructure, and sustainable design principles for applications and data. Using real examples from industries like aviation and packaging, the talk shows how companies are cutting carbon emissions, adopting smarter designs, and shifting to eco-friendly materials. We hope that students will gain a clear understanding of the challenges, opportunities, and transformative potential of sustainability in shaping a resilient, low-carbon future.

# UN’s Sustainable Development Goals through cross-industry implementation

**Mr. Saptaswa Sarkar**
**Air Asia**

The overview explores the UN’s Sustainable Development Goals (SDGs) through the lens of cross-industry implementation and strategic roadmaps. We examine how global sectors are leveraging next-generation AI models to accelerate sustainability targets and optimize resource management. Central to this discussion is the pivotal role of 'Affordable and Clean Energy' in driving decarbonization, providing a clear pathway for industries to transition from traditional energy dependency toward total carbon neutrality.



# 03
# Abstract of accepted papers

# SCHOLAR'S ANALYZER: A PREDICTIVE MODELING TOOL FOR GPA STRATEGY AND ACHIEVEMENT FORECASTING

**SEEMA JOGAD*; LARAIB ERAM ANSARI; BHANU PRATAP SINGH; OMKAR MISHRA**

**MANGALMAY INSTITUTE OF MANAGEMENT AND TECHNOLOGY**

Academic performance tracking remains a cause for grave concern among university students, impacting directly on graduate admissions, scholarship eligibility, and employment opportunities. Despite the availability of basic calculators, reliance on manual computation or static spreadsheets continues to drive students toward retrospective analysis rather than strategic planning. This paper proposes a digital remedy: "ScholarIQ," an intelligent interactive portal with the aim of linking historical grade data with future academic goals in real time. The platform is a computation engine and strategic advisor for the management of credit loads in an analytically sound manner. The portal includes a "Future Goal Strategizer," easy to-use dashboards, predictive modeling, and secure cloud-based data persistence. In addition, it allows students to input semester records, visualize performance trends, and evaluate the attainability of target GPAs, which makes the goal-setting process transparent and realistic. In this way, the system calculates the exact performance needed for future semesters and reduces students' academic anxieties and other obstacles to planning. Data visualized by means of the portal also enables students to monitor longitudinal consistency and identify best-performing semesters. It also includes different sections for the ease of user like "Feasibility Assessment", "Semester Logs" etc. Responsive user interface implemented using HTML, Tailwind CSS, and JavaScript, with a Firebase backend; the advanced visualization features added, keeping in mind the growing demand for clear data-driven insights in education.

# LEARNING-DRIVEN MULTI-ROBOT COORDINATION FOR DYNAMIC AND UNCERTAIN TASK ALLOCATION

**NILADRI PAUL*; ADRIJA GHOSH; ANUSHA SARKAR; BUDDHADEB PRADHAN; SAIKAT MAJUMDER; SUDIPTO DHAR**
**UNIVERSITY OF ENGINEERING AND MANAGEMENT, KOLKATA**

In practical implementations, multi-robot systems are applied where all the robots collaborate to make decisions and also share tasks in dynamic and uncertain environments. It is difficult to assign tasks to robots in multi-robot systems because they cannot observe everything, they have different abilities, and they can only communicate with each other in certain ways. In rule-based and optimization techniques, models and assumptions are fixed, and it is difficult for them to adapt to uncertain environments, and as a result, performance tends to degrade with the size and complexity of the systems. This paper proposes a learning-based framework that allows multiple robots to learn insights from their past experiences and improve their performance. The proposed approach employs reinforcement learning to train each robot to collaborate with other robots based on data collected from real-world experiences and simulated scenarios. Learning-based strategies are integrated with simple rules of engagement to enable robots to operate autonomously, remain stable, and react quickly to changes in tasks. The proposed approach is validated to complete tasks 18.6% faster and increase the efficiency of task assignment by 22.4% compared to conventional optimization techniques. The proposed framework is also found to perform well with an increasing number of robots, with the loss of efficiency of less than 6% when the number of robots is varied from 5 to 25. The experimental results also show that the proposed framework performs better in handling communication delays and task changes, with a 27.1% improvement in the reduction of task failures in dynamic environments.

# AI-DRIVEN UNDERWATER DENOISING AND REAL-TIME MARINE SPECIES ANALYSIS WITH DISEASE DETECTION

**NITHA FATHIM**

The ability to monitor underwater ecosystems is essential for evaluating the health of the marine ecosystem, as well as observing how fish populations behave and what their abundance is. Conversely, traditional methods of observing fish in aquatic ecosystems are really limited by their environments due to a lack of visibility, environmental noise (such as background acoustic signals), and/or manual inspection (which can result in incomplete or inaccurate data). In this research, we introduce an innovative method for conducting underwater fish species identification, an AI-based denoising and marine analysis system. The method consists of using U-Net to process the underwater images, with the aim of denoising (removing noise), enhancing the visibility of the image, and segmenting (isolating) the objects of interest, so that they can be properly translated into useful information about fish abundance and behavior, even in difficult circumstances. The second part of the process involves utilizing the YOLO model, to perform real time fish detection, species classification and population counting. We also use YOLO to identify any signs of disease related issues (such as bacterial or parasitic infections) that are visible in the denoised regions of interest. Our approach provides a comprehensive solution for fully automating marine monitoring (which includes image enhancement, detection, classification, and detection of disease), ultimately providing a solid foundation for sustainable ecosystem management, fisheries monitoring and conservation efforts, demonstrating how well deep-learning models can work together to produce high-accuracy real-time underwater monitoring.

# ADAPTIVE DROOP-GAIN MODEL PREDICTIVE CONTROL FOR ENHANCED EFFICIENCY AND POWER QUALITY IN RENEWABLE MICROGRIDS

**A, VASANTHI; S, GOWTHAM; R, SANKAR GANESH; R, VINISHA ; P, SONIYA; S, ANNAMALAI**

**K.S.R.COLLEGE OF ENGINEERING**

The large penetration of renewable energy resources in microgrids creates difficulties in ensuring voltage stability, power quality, and efficiency, as the traditional proportional-integral (PI) controller shows less adaptability in dynamic environments. This paper presents an Adaptive Droop-Gain Model Predictive Control (ADG-MPC) technique that replaces the conventional PI controller with a dynamically adjusted droop controller coupled with a Model Predictive Control layer to reduce voltage deviation, frequency variation, and control effort. A Dynamic Voltage Restorer (DVR) is employed to counteract voltage sag and disturbances, and the compensation effect is confirmed by using grid, injected, and load voltage signals. Simulation outcomes show a 3% reduction in voltage and frequency variations, a remarkable improvement in settling time, a THD value of 1.1%, and an efficiency increase of 5%. The proposed method ensures stable, efficient, and high-quality power in renewable microgrids.

# HIGH EFFICIENCY SOLAR JACKET WITH ML FOR BATTERY – POWERED WEARABLE DEVICES

**MALATTHI SIVASUNDARAM*; PRAKASHAM V; NITHYA P ; HARIPRIYA R; ARUNA P; BALAJI J**

**KSR COLLEGE OF ENGINEERING**

The aim of this project is to propose a smart health Solar jacket design to precisely monitor the health of people and remain operational with power management to avoid unnecessary energy usage to enhance security. The existing design of health monitoring jackets is completely based on battery-operated designs that influences SVM (Support vector Machine) and Decision tree. The new system suggests a Solar-powered monitoring jacket that has flexible solar panels and a smart energy retrieval and management algorithm named as VITALNET. The Solar Jacket model performed better than battery-based jacket with higher accuracy, 96.1% versus 95.4%, improved precision of 97.5%, recall of 97.2%, and F1-score of 97.3%. The performance improvement was statistically significant ($p < 0.05$), which further confirms that the proposed approach has been effective. This jacket is a feasible approach for continuous health monitoring with VITALNET rather than SVM and Decision tree models. The autonomous system is robust and works in austere conditions and, therefore, offers greater safety and comfort to the users.

# A NOVEL LLM-RAG APPROACH FOR RISK-AWARE ANTI-MONEY LAUNDERING COMPLIANCE

**R, MANOJA*; P, RATHIKA; B, SRIVIDHYA; K, HARIHARAN; M, AKSHAYA; P, JANAKI**
**KSR COLLEGE OF ENGINEERING**

This study aims to develop a Novel LLM-RAG based Risk-Aware Anti-Money Laundering framework to detect phishing links, fake OTPs, suspicious calls, and fraudulent transactions while reducing the false positives using content-aware analysis. Group 1: refers Random Forest and LSTM analyze structured transaction features and historical fraud details to detect suspicious activities. Group 2: refers to the novel LLM-RAG framework that integrates structured transaction data with unstructured fraud intelligence to perform contextual reasoning,risk scoring, and generate explainable alerts. The LLM-RAG based Anti-Money Laundering framework outperforms the LSTM and Random Forest models. The accuracy of the framework ranges between 75% and 92%, with an average accuracy of 83.75%, which is greater than the existing methods. The proposed framework also shows better precision, recall, and F1-score values of 81.00%, 78.25%, and 79.50% respectively. Statistical analysis proves that the improvement in performance is highly significant $p < 0.001$. The Large Language Models with Retrieval Augmented Generation system provides high accuracy and enhanced security for AML compliance by integrating the analysis of structured and unstructured data with the intelligence of LLM-RAG, which leads to accurate risk assessment, low false positives, and enhanced financial security. This framework supports the transaction monitoring system, enables effective risk scoring, and ensures risk-aware compliance through detailed statistical performance analysis.

# AI ASSISTED META-ORGANIC-FRAMEWORK (MOF) DESIGN-A NEW ERA OF MATERIAL SCIENCE

**PODDER, DR. SOUMIK*; ROY, SOHAG**
**INSTITUTE OF ENGINEERING AND MANAGEMENT NEW TOWN, UNIVERSITY OF ENGINEERING AND MANAGEMENT KOLKATA**

Metal–Organic Frameworks (MOFs) are one of the porous crystalline materials, which are extensively employed in diverse applications including gas sensing, drug delivery, catalysis, and energy systems. Traditional chemical synthesis of MOF is based on trial - error method that is subjected to, increased costs, longer synthesis time, and non-benign chemical byproducts. Recent progress in AI, ML, LLMs, and self-driving laboratory offer a radical slant to accelerate MOF design, synthesis, and optimization. In this present work, a unified AI/ML-driven scaffold is presented with the aim of advancement in next-gen MOF progress. This context fuses data-determined chemical structure prediction, inverse design, RL based materials articulation, green chemistry optimization. Insights from latest advancements in AI-assisted MOF discovery, LLM-driven scientific literature data mining, and eco-friendly precursor substitution strategies are explored here. The proposed framework integrates generative models like VAE, Supramolecular VAE (SmVAE), ChatMOF, CCA, Active learning(AL), autonomous laboratory experiments, and sustainability-focused optimization, to offer a closed-loop MOF discovery. This work will be a guideline for researchers to design MOF with higher accuracy, scalability and techno-economics.

# SMART MIRROR WITH AI-POWERED FACIAL AND BODY LANGUAGE RECOGNITION FOR HEALTH TIPS AND CONTEXTUAL EMOTION RESPONSE

**VINOLY G*; RATHIKA P ; PRIYADHARSHINI A ; BHARATH R; PRABAHARAN V ; UMAMAGESHWARI K**

**K S R INSTITUTE FOR ENGINEERING AND TECHNOLOGY**

This research describes an IoT-based Smart Mirror, which should track the physical and emotional well-being of the users in real-time. The operating system uses RGB cameras, pose-estimation sensors to record facial micro-expressions, body posture and gestures. A multimodal deep learning system combines the convolutional neural networks (CNN) to extract facial features, support the analysis of skeleton-based body posture, and recognize emotions with attention, which allows developing a complex perception of what is going on with the user at that moment. The Smart Mirror has an interactive LCD display, which gives the user real-time feedback and includes posture correction, stress warnings, and customized wellness suggestions. IoT connectivity enables the coordination of user data to cloud-based analytics, enabling remote monitoring, trend analysis and access to multiple devices. Hybrid edge-cloud processing architecture ensures that the inference is low-latency, as well as scales with numerous users. Placed in a real-world situation, experimental assessment proves that the system is able to discover minor emotional shifts and posture deviations. The solution can be implemented in everyday life and adopted as an intelligent health companion as it is non-invasive, user-friendly, and adaptable to use daily. The present work emphasizes the possibility of using AI, IoT, and human-computer interaction technologies to promote individual monitoring of health and preventive health management.

# STABILITY-ORIENTED CONTROL OF FREQUENCY AND VOLTAGE IN MICROGRID CONNECTED TO SMART GRID

**E, VANI*; R, SACITHRAA; M A, STEPHENRAJ; C, AJAYKUMAR; P, GOWSIK; R K, SARAVANAKKUMAR**

**K S R INSTITUTE FOR ENGINEERING AND TECHNOLOGY**

The primary goal of this project to develop and validate the Stability Oriented Adaptive Droop Control Strategy for a grid-forming inverters in microgrids that can effectively enhance Voltage Regulation, Frequency Response and Power Sharing under high penetration of inverter based distributed energy resources (DERs) and varying operating conditions. Materials and Methods: Group 1 comprises 20 samples of Conventional droop control shows low virtual inertia and damping on power variations in power sharing efficiency. Group 2 comprises 20 samples of AI-Based Adaptive Droop Control Strategy and the performance of the two options was assessed at various levels of power sharing utilizing both MATLAB software (Version R2025a) and a hardware prototype tested the frequency deviation, voltage fluctuations and power sharing efficiency in microgrids. Result: The proposed AI-Based Adaptive Droop Control reduces the maximum frequency deviation from 0.8 Hz to 0.2 Hz by representing an improvement of approximately 75% under fluctuations. Voltage deviation is limited within 3% compared to 8% when compared to the conventional droop control. The settling time of frequency response is reduced from about 2.5 s to 0.9 s by achieving nearly 64% faster dynamic response. Accurate active and reactive power sharing is maintained with a mismatch of less than 5% among parallel inverters. Conclusion: From the experimental results, it can be concluded that an AI-Based Adaptive Droop Control Strategy has the better performance than Conventional droop control for the frequency deviation, voltage fluctuations, robustness and power sharing efficiency of active and reactive power.

# EXPLAINABLE CNN-BILSTM FOR ECG BEAT CLASSIFICATION: INTEGRATING JACOBIAN SENSITIVITY AND 1D GRAD-CAM FOR UNCERTAINTY-AWARE RELIABILITY

**MITRA, SUPARNA*; DAS, MAUMITA**
**(UNIVERSITY OF ENGINEERING AND MANAGEMENT , KOLKATA**

Accurate deep learning models for ECG beat classification are essential for reliable arrhythmia detection, yet their black-box behavior limits interpretability and real-world deployment. This paper proposes an explainable CNN-BiLSTM framework for 5 AAMI-class ECG beat classification (N, S, V, F, Q) on the MIT-BIH Arrhythmia Database, achieving high performance (96.05% accuracy) through patient-wise splitting, bandpass filtering (0.5–40 Hz), R-peak-centered beat extraction, NSTDB noise augmentation during training, and class-weighted optimization. The proposed system integrates a unified trust score using two post-hoc explainability techniques—Jacobian-based temporal sensitivity and 1-D Grad-CAM—to analyze model decisions on R-peak-aligned beats. The XAI techniques consistently highlight the QRS complex and ST/T segments, showing cases where high prediction confidence is accompanied by diffuse or weak attribution. The proposed framework advances safer and more transparent explainable AI systems that explicitly identify predictions which should be reviewed with caution.

# AGRO-GUARD: SMART IOT BASED SOLUTION FOR CROP MONITORING IN GRAIN SILOS

**BANDYOPADHYAY, BEDANTA*; DAS, IPSHITA; SENGUPTA, RIMI; DAS, ARPITA; CHATTOPADHYAY, ABIR**

**UNIVERSITY OF ENGINEERING & MANAGEMENT, KOLKATA**

Accurate deep learning models for ECG beat classification are essential for reliable arrhythmia detection, yet their black-box behavior limits interpretability and real-world deployment. This paper proposes an explainable CNN-BiLSTM framework for 5 AAMI-class ECG beat classification (N, S, V, F, Q) on the MIT-BIH Arrhythmia Database, achieving high performance (96.05% accuracy) through patient-wise splitting, bandpass filtering (0.5–40 Hz), R-peak-centered beat extraction, NSTDB noise augmentation during training, and class-weighted optimization. The proposed system integrates a unified trust score using two post-hoc explainability techniques—Jacobian-based temporal sensitivity and 1-D Grad-CAM—to analyze model decisions on R-peak-aligned beats. The XAI techniques consistently highlight the QRS complex and ST/T segments, showing cases where high prediction confidence is accompanied by diffuse or weak attribution. The proposed framework advances safer and more transparent explainable AI systems that explicitly identify predictions which should be reviewed with caution.

# ENHANCED LIBRARY ASSISTANT USING RASA NLU AND CONVERSATIONAL DIALOG ORCHESTRATION FOR ACCELERATED RESERVATIONS AND INTELLIGENT TRACKING

**M, VENKATESAN; V, SHARMILA*; K, BALAJI; B, AKSHAYA; M, KANISHKA ; K, KEERTHANA**
**K.S.R.COLLEGE OF ENGINEERING**

This study is to create a transactional library assistant based on the Rasa framework to automate, increase accessibility, and real time resource management of the service. This paper suggests a comprehensive conversational AI model that provides the middle ground between the basic retrieval of information and useful database processes such as book reservations and renewals. Group 1: Represents the existing methodology, which adheres to a classic approach based on the use of keyword approach with the help of TF-IDF(Tern Frequency-Inverse Document Frequency) to transform a feature as a vector and Naive Bayes to classify the intentThis approach is based upon frequency based statistical trends, which are not always suitable in semantic terms to provide complex natural language variations in library specific queries. Group 2: Represents the proposed method that involves the Rasa framework to deliver an interactive application that is automated with 400-500 intent-based samples such as book enquiry and check due date. This conversational AI model combines high-accuracy Natural Language Understanding with a custom Action Server for real-time SQL database interaction. Through these characteristics, the system identifies user intent with great efficacy and executes library transactions in real time, producing fast and accurate results for modern digital universities.

# DESIGN AND IMPLEMENTATION OF A UAV-ASSISTED AD-HOC COMMUNICATION NETWORK USING ESP32 FOR DISASTER AND INFRASTRUCTURE-LESS ENVIRONMENTS

**PODDER, DR. SOUMIK*; BORAL, SOMA; BISWAS, SWAGATAM; PAUL, PAULOMI; MONDAL, ARUN**
**UNIVERSITY OF ENGINEERING & MANAGEMENT, KOLKATA; GURU NANAK INSTITUTE OF TECHNOLOGY, KOLKATA**

Finding reliable communications can be a significant challenge in disaster-struck and infrastructure-less locations where mobile network towers and communication nodes are either down or non-existent. In this paper, we present a UAV-assisted wireless ad-hoc communication system for offering voice and emergency communication among users in such environments. It utilizes ESP32-based end-user devices, designed with microphones, speakers, control buttons and alarm indicators for voice communication and SOS distress signals.

UAVs perform as air-borne relay nodes to cooperate a Wi-Fi ad hoc network for receiving/sending communication packets from/to ground users. Voice data is sent in real-time (e.g., via UDP communication) and a special UAV serves to store–carry–and–forward packets when users cannot communicate directly or are out of reach. Priority treatment is used to transmit emergency SOS packets before normal voice packets, which allows an important communication link not to be lost

# A HYBRID BLOCKCHAIN ARCHITECTURE FOR SECURE AND PATIENT-CENTRIC ELECTRONIC HEALTH RECORD (EHR) MANAGEMENT

**SHAW, VIVEK KUMAR ; RAJ, HEMANT ; SHARMA, RISHAV ; ANJALI, KUMARI ; KUMAR, MADHUSUDAN ; KUMAR, ROUNAK ; BISWAS, ARPITA***

**UNIVERSITY OF ENGINEERING & MANAGEMENT, KOLKATA**

Medical records are very sensitive and contains important data. It needs to be stored in such a manner that it can be accessed by the authorised person anywhere in a convenient manner and at the same time it should be immutable. Today medical records are stored electronically, which has both advantages as well as disadvantages. It allows the healthcare providers and patients to store and access patient data using electronic gadgets like phones, personal computers and laptops, but it brings a serious problem with it. If the database where the medical records are stored is unethically misused, then the entire patient data can be manipulated, which can be life-threatening for the patient. This paper explores the various ways of securing patient data using blockchain and suggests a hybrid model which uses blockchain in such a manner that the patient data is secure, cost of storing data is low and the patient can control who can access his medical records. This hybrid model stores the actual data in a database and a hash of the entire data on a blockchain so if the database is manipulated then it can be easily detected. This model allows patient to easily shift from one hospital to another if required. This work aims to reduce medical data fraud, prevent unauthorised modifications in data, and provide a safe and efficient way to access patient records anytime when required.

# HYBRID SECURITY FRAMEWORK: INTEGRATING POST-QUANTUM AND LIGHTWEIGHT CRYPTOGRAPHY FOR THE IOT ECOSYSTEM

**PAUL, ABHIK ; PAUL, DALIYA ; LODHA, BHUMI ; SINGH, KUNAL ; MONDAL , SAYANDEEP ; SARDAR, DISHA; BISWAS, ARPITA***

**UNIVERSITY OF ENGINEERING & MANAGEMENT, KOLKATA**

In the last decade, the growth of IoT has brought many crucial security issues- with quantum computing on the horizon, traditional cryptography such as RSA and ECC will soon become ineffective. Things are further complicated because most IoT devices are lightweight and do not have enough computational power to implement most post-quantum algorithms. This paper discusses 'Harvest Now, Decrypt Later' attacks. Therefore, this paper presents a Hybrid Security Model of Lightweight Cryptography (LWC) and Post-Quantum Cryptography (PQC). The model shifts the challenging cryptographic work to the edge of the network instead of demanding that small devices carry the entire burden, intending to protect data from IoT devices at the source. It combines CRYSTALS-Kyber for quantum-safe key exchange with ASCON-128 for fast, authenticated encryption. This is to ensures that data is secured while being transmitted without consuming much power in the IoT devices. The hybrid method has also been has also been proven to withstand classical side-channel attacks and any future threats posed by quantum computing. This method is most suitable for use in critical applications like smart grids and medical devices.

# A COMPREHENSIVE THERMAL HARDWARE-IN-THE-LOOP (ET-HIL) SIMULATION FRAMEWORK FOR DETERMINING THE CHANGING PARAMETERS OF BATTERY HEAT MANAGEMENT SYSTEMS (BMS)

**ROY, ARINDAM*; GANGULY, ANIRBAN; KAIRI, ANIMESH**

**INSTITUTE OF ENGINEERING & MANAGEMENT, KOLKATA**

Analysis of Battery Heat Management Systems (BMS) is part of the review of maximising the functionality, security and the life time of rechargeable battery packs, particularly in electric automobiles (EVs)[14], grid storage and aerospace uses. With the increase in complexity of battery systems as well as sensitivity to temperatures, assessing the effectiveness of BMS is challenging. correctly in real-life situations. The traditional simulation tools usually do not have a high fidelity with real physical hardware, especially thermal behaviour. In this paper, a broad-based Thermal Extended Hardware-in-the-Loop[2] (ET-HIL) simulation system is suggested that is capable of combining real-time thermal behaviour with BMS hardware to test thermal strategies, safety margin and control reaction using an Arduino simulator and Arduino IDE. The suggested arrangement provides the opportunity to conduct an in-depth analysis of the performance of BMS in different thermal loads, fault states, and ageing. It has been shown that outcomes are more accurate in forecasting temperature evolution and thermal events, and the effectiveness of the BMS control as opposed to traditional software-only models.

# IMFREQ-LITE: A LIGHTWEIGHT SPECTRAL-STATISTICAL FRAMEWORK FOR IOT ANOMALY DETECTION IN SMART CITY ENVIRONMENTS

**KAR, TAPOJITA*; KONAR, BASABDUTTA**

**INSTITUTE OF ENGINEERING & MANAGEMENT, KOLKATA**

Time-series anomaly detection is really important for smart cities, IoT systems, and industrial sensors. While deep learning methods like LSTM autoencoders and Temporal Convolutional Networks have worked well, they need a lot of computing power, which makes them hard to use on devices with limited resources. That's why we're proposing ImFREQ-Lite, a lightweight framework that uses frequency-domain features and time-domain statistical descriptors to detect anomalies. We've developed a five-stage pipeline that includes temporal windowing, FFT extraction, statistical fusion, post-windowing SMOTE oversampling, and soft-voting RF+XGBoost ensemble classification. This pipeline can run on a free-tier CPU in just 60 seconds. We've also done three detailed ablation studies using publicly available benchmarks like ToN-IoT, SKAB, and NAB Yahoo S5. Our results show that ImFREQ-Lite outperforms all nine baselines, including TCNs and quantized Transformers, with a minority-class F1 of 0.891 and PR-AUC of 0.907 on ToN-IoT. This is statistically significant, with a p-value of 0.041 or less. What's more, ImFREQ-Lite requires 60 times less training time and 6 times fewer FLOPs than the LSTM autoencoder. We've also tested our framework on a Raspberry Pi 4 with 4 GB RAM, and it works really well. The inference latency is just 18.3 microseconds, the memory footprint is 121 MB, and the energy consumption is 5.71 microjoules per inference. This means that the battery life is around 28.1 hours at 1 sample per second. We've also done a sliding-window streaming simulation in real-time on the same device, and it shows an end-to-end pipeline latency of just 0.62 milliseconds with ADWIN-based concept drift monitoring. Overall, ImFREQ-Lite is a powerful and efficient framework for time-series anomaly detection that can be used in a variety of applications.

# A CNN METHOD FOR BRAIN TUMOR DETECTION WITH MULTIPLE OPTIMIZATION TECHNIQUES

**VENKATA CHARAN KUMAR, B.; VENKATESH NAIK, NANAVATH; JASWANTH, SANKALA*; THARUN KUMAR, KODIGANTI ; NABI RASOOL, SHAIK ; KUMARASWAMY, VANKAM**

**SANTHIRAM ENGINEERING COLLEGE**

Brain cancers kill many worldwide. Diagnosis and identification of tumors are performed based on practically every case with the help of magnetic resonance imaging (MRI). By weight initialization, optimization algorithm, batch size, epoch, learning rate, activation function, loss function, CNN architecture, and other factors, convolutional neural networks (CNN) are different in their performance and effectiveness for brain tumor detection. Activation functions improve neural networks visibility and robust pattern recognition. This paper finds the right optimizer for any segmentation or detection, depending on trustable testing and validation. The research aim is to find the optimal CNN architecture with five convolutional layers, five max-pooling layers, and four fully linked layers for brain tumour detection. Three custom CNN models are implemented with various activation functions (Tanh, ReLU, and ELU) and optimizers (Adam, SGD, Adagrad, Adadelta, and RMSProp). The result analyses on four category of brain tumour including glioma, meningioma, pituitary tumors, and no tumor instances on a dataset consisting of 3,264 brain MRI scans. Evaluation leads to the conclusion that Adam's optimizer is best and achieves 94% accuracy. Stakeholders and medical professionals can use these results to perform accurate, prompt brain tumour identification from MRI scans.

# TRAFFIC CONGESTION LEVEL PREDICTION USING TEMPORAL, WEATHER AND EVENT BASED FEATURES

**VENKATA CHARAN KUMAR, B.; VENKATESH NAIK, NANAVATH; JASWANTH, SANKALA*; THARUN KUMAR, KODIGANTI ; NABI RASOOL, SHAIK ; KUMARASWAMY, VANKAM**

**SANTHIRAM ENGINEERING COLLEGE**

Traffic congestion is a critical issue in rapidly growing urban environments, leading to increased travel time, fuel consumption, and reduced quality of life. This paper proposes a multi-stream traffic prediction system that incorporates different forms of data such as time-based, weather-based and event-based data to forecast traffic congestion levels categorized as HIGH, MEDIUM, or LOW.The aim of the research is to come up with a system that will effectively predict the congestion patterns, which will assist the commuters and city planners in making sound decisions.

Traffic congestion is categorized based on integrated temporal, weather, and event-based features using machine learning models including Logistic Regression, SVM, Random Forest, and XGBoost. Performance measures such as accuracy, precision, recall and F1-score are used to evaluate the models and the emphasis is laid on dealing with class imbalance. A structured synthetic dataset representing hourly traffic conditions in Bangalore was constructed to enable controlled evaluation of multi-stream feature fusion.

The findings indicate that Random Forest and XGBoost achieve approximately 99% classification accuracy and demonstrate robust performance across all congestion categories. The results indicate that combining a variety of data streams significantly improves predictive accuracy in comparison with the use of a single source of data.

This system is carried out using a web user interface that enables hourly congestion prediction using a structured synthetic dataset. It is usable and can be replicated to other cities, bringing up a data-based solution to improved traffic management and city planning.

# SPEECH BASED MENTAL HEALTH DETECTION USING PRETRAINED WAV2VEC2 AND DEEP LEARNING

**DAS, RANJAN *; MAITY, MANOTOSH; SARKAR, SHOUVIK**

**BRAINWARE UNIVERSITY**

Mental health disorders such as depression and anxiety are placing a heavy burden on healthcare systems around the world. Early detection is difficult because it is based on subjective clinical assessment and there is insufficient access to mental health professionals. Speech signals provide biomarkers both of their acoustic and linguistic nature that relate to emotional and cognitive states, thus providing an alternative non-invasive method for assessment. This study introduces a speech emotion recognition framework based on deep learning approach using pretrained Wav2Vec2 model trained on the IEMOCAP. The system is implemented using SpeechBrain and evaluated as a cloud-based system. Experimental results show better performance in classification than traditional feature engineering methods, showing that it is scalable and can be applied to telehealth-based mental health screening applications.

# DESIGN AND DEVELOPMENT OF AN AI-INTEGRATED IOT FOOD SERVING ROBOT FOR CONTACTLESS HOSPITALITY SERVICES

**DE, SWASTIK*; MUKHERJEE, SOUMYADIPTA; GHOSH, SUDIPTA**

**UNIVERSITY OF ENGINEERING & MANAGEMENT, KOLKATA**

Currently, robotics and automation have enhanced the productivity of various industries and just like many others, the hospitality sector is benefited from this transformation. This report focuses on a smart robot that serves food at restaurants, which is intended to reduce human effort and improve service delivery. It has the ability to serve food autonomously by navigating through given definite path and stop at serving points where it can give food orders. This robot can communicate with customers in various languages through a voice module. The robot's hardware includes arduino uno and nano microcontrollers which drive the DC motors with the L298N motor driver. The system's voice module serves customers in English, Hindi and Bengali, which increases the business engagement and overall experience. The solid structure of the robot with four food trays (two at the front and two at the back) can be used to serve multiple orders at once for different customers. The extensive combination of motion control, multilingual communication, hardware components, sensor-based navigation and developed robotics makes this project the ultimate multi-purpose approach aimed at meeting the automation needs of modern restaurants.

# AI-BASED ELEPHANT DETECTION AND TRAIN COLLISION AVOIDANCE SYSTEM FOR FOREST RAILWAY CORRIDORS

**PAN, HRISIKESH*; KARMAKAR, SOUMYADEEP ; DAS, MAUMITA ; DAS, ARPITA ; SENGUPTA, RIMI ; BISWAS, SAIKAT**

**UNIVERSITY OF ENGINEERING & MANAGEMENT, KOLKATA**

The train-wildlife collisions in the forest railway country of India represent a formidable challenge, particularly within the North Bengal region where elephants migrate through this area. The elephants typically use traditional migration pathways that cross directly over the railway lines causing collisions and interruption to railway operations. Even with speed restrictions, monitoring systems for trains and elephants, train-wildlife collision incidents continue to take place. These collisions are attributed not only to the limited number of train/elephant real-time location alerts but also to the positioning of the alert at a point of location after the collision has already occurred, which makes it impossible to avoid the collision. The current work describes an Artificial Intelligence (AI)-based elephant detection and train collision avoidance system that provides continuous corridor monitoring of railway infrastructures, automated detection of elephants, and rapid communication capabilities between railway infrastructure and trains.

# MACHINE LEARNING-BASED MULTI-DISEASE OUTBREAK PREDICTION

**SHAW, ABHIJIT*; SURAL, ABIR**

**INSTITUTE OF ENGINEERING & MANAGEMENT, KOLKATA**

Early diagnosis of chronic diseases is required for preventive healthcare and effective medical planning. Our paper presents a machine learning based approach of a multi disease prediction system which is capable of predicting quite accurately the problems of Diabetes, Heart Disease and Parkinson's Disease with the help of clinically validated datasets. Our system is divided into stages that consists of data preprocessing, feature engineering and classification algorithms to generate predictions. To handle class imbalance Tomek's Link undersampling method is applied. Multiple classification models including Logistic Regression, Decision Tree, Random Forest and Support Vector Machine were evaluated and the best-performing model was deployed. A web application was developed using Streamlit to allow users to input health parameters and obtain predictions in real-time. The proposed system provides an accessible, low-cost, and efficient healthcare decision support tool for early disease risk assessment.

# RECONSTRUCTION OF ARTERIAL BLOOD PRESSURE (ABP) WAVEFORMS FROM PHOTO PLETHYSMOGRAPHY (PPG) USING PIX2PIX CONDITIONAL GENERATIVE ADVERSARIAL NETWORKS (GAN)

**SAHA, MADHUHRITA*; DEY, KARUNAMAYEE ; ROY, SUNIPA ; KANTHA, BIJOY**

**INSTITUTE OF ENGINEERING & MANAGEMENT, KOLKATA**

Continuous observing of arterial blood pressure (ABP) is critical for controlling hypertension and diseases related to cardiac. However, invasive measurement remains the benchmark for limitations for long-term monitoring. In wearable technology, non-invasive and easily available photoplethysmography (PPG) offers a realistic approach for recreating ABP waveforms. Offers a possible method for modelling ABP waveforms. Recent deep learning models, including SE-Net, cascaded CNNs, U-Net variations, and attention-based architectures, have demonstrated promising results, but challenges in waveform distortion, phase misalignment, and subject-specific performance remain. In this work, we propose a Pix2Pix Conditional Generative Adversarial Network (cGAN) utilising a 1D U-Net generator and a PatchGAN discriminator to regenerate ABP waveforms from PPG signals. The model evaluation can be performed by mean absolute error (MAE), root mean square error (RMSE), and correlation. Pix2Pix achieved an MAE of 2.67 mmHg, an RMSE of 3.98 mmHg, and a correlation coefficient of r = 0.989, leading methodologies such as PPG2ABP (MAE 4.6 mmHg) and SE-Net (r = 0.92), utilising exclusively photoplethysmography (PPG) as input. Subject-specific W-Net and U2-Net models are intensive, while Pix2Pix offers a favourable balance between accuracy, robustness, and efficiency. The proposed work demonstrates the ability of GAN-based designs for the reconstruction of physiologically realistic waveforms, enabling the use of them in wearable and mobile health-monitoring devices.

# WIRELESS BODY AREA SENSOR NETWORK BASED HUMAN ACTIVITY RECOGNITION SYSTEM

**SAHA, SOMOSHREE; BASULI, PRIYA ; RANI, VARSHA ; DEY, NAIWRITA ; GHOSH, ARIJIT***

**RCCIIT**

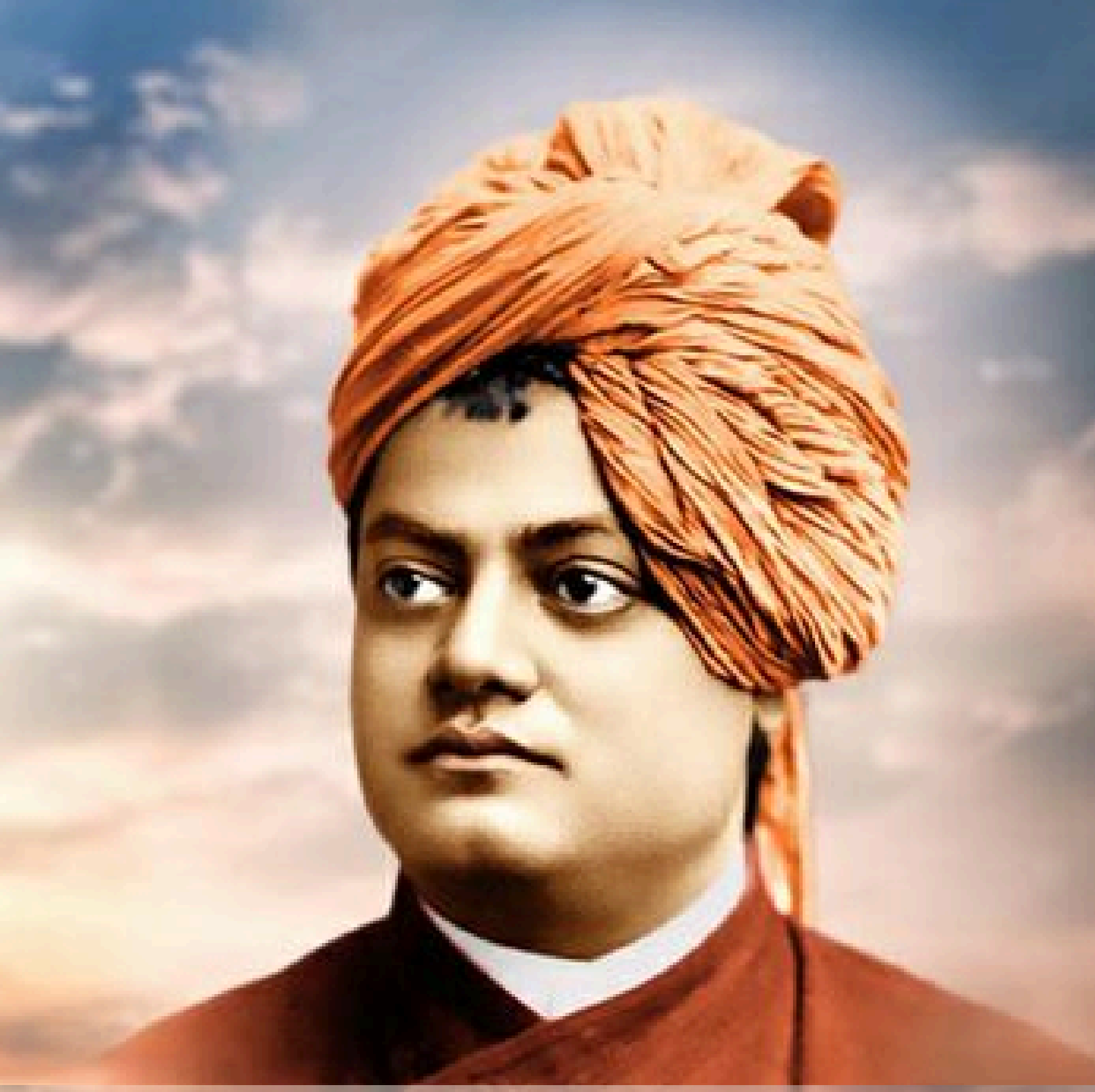
As the growth of wearable technology increases rapidly ,the rising need for remote health monitoring, Wireless Body Area Sensor Networks (WBASNs) have become essential in the development of real-time Human Activity Recognition (HAR) systems. This paper proposes a Human Activity Recognition (HAR) system based on a Wireless Body Area Sensor Network (WBASN). The architecture uses wearable sensors to collect body motion data. This data is furthur transmitted wirelessly for preprocessing and classification through machine learning algorithms. The focus of this paper remains on providing a strong solution, as it puts energy-efficient data transmission and privacy-preserving processing as its priority , for real-time monitoring in healthcare and assisted-living environments.

# A SELF - SUPERVISED BILSTM DENOISING AUTO ENCODER FOR ROBUST DENOISING OF PHOTOPLETHYSMOGRAPHY SIGNALS

**DEY, RIJHI***

**UNIVERSITY OF ENGINEERING AND MANAGEMENT,KOLKATA**

Photoplethysmography Signals (PPG) can be used as an effective form of non-invasive health monitoring in a variety of settings; however, due to its high susceptibility to noise and motion artifacts. A lot of supervised deep learning models and traditional filtering techniques rely on clean data or artificial assistance, making them unsuitable for correcting these issues. As a result, a self-supervised temporal-aware denoising framework based on BiLSTM-DAE has been proposed as a solution to this issue. This framework uses intrinsic temporal redundancy to repair corrupted PPG signals without requiring the use of additional sensors/clean labels. The method was tested using the MIMIC-II dataset clinically derived. The proposed approach achieves a good balance between preserving physiologically relevant data and reducing noise. It also has a RMSE of 0.118 and a heart rate difference of 0.30 BPM between the processed PPG signals and the original PPG signals. When combined, this performance outperforms CNN-based denoisers and standalone recurrent models. The framework offers significant advantages, including temporal awareness, label-free training, and wearable device compatibility. All things considered, this work shows that self-supervised temporal restoration is a useful and efficient way to reduce PPG noise in wearable and clinical monitoring applications.



ARISE, AWAKE
AND
STOP NOT
TILL THE GOAL IS REACHED