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SEACOM SKILLS UNIVERSITY
Expanding the Boundaries of Knowledge

INTERNATIONAL CONFERENCE ON

INTELLIGENT COMPUTING AND EMERGING TECHNOLOGIES

(ICICET)-2026

Innovating the Future | AI • IoT • Cyber Security • Emerging Technologies • Research

BOOK OF ABSTRACTS

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Intelligent Computing and Emerging Technologies (ICICET-2026)

Editors

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Mr. Bijoy Pal

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PREFACE

It gives us immense pleasure to present the **Conference Proceedings of the International Conference on Intelligent Computing and Emerging Technologies (ICICET 2026)**, organized by **Aspinotech Infosolutions Pvt. Ltd.**, in association with **Seacom Skills University**, Bolpur-Santiniketan, West Bengal, India, on **22–23 August 2026** in hybrid mode. The conference brings together researchers, academicians, scientists, industry professionals, research scholars, and students to share knowledge, exchange ideas, and explore emerging developments in intelligent computing and interdisciplinary technologies. The conference invitation highlights its central theme of *"Innovating Today for a Smarter Tomorrow,"* reflecting the broader vision of connecting innovation, collaboration, technology, knowledge, and future-oriented research.

ICICET 2026 provides a multidisciplinary platform covering contemporary areas including **Artificial Intelligence and Machine Learning, Internet of Things, Cyber Security, Cloud Computing, Robotics and Automation, Data Science and Analytics, Signal Processing, Antennas and RF Technologies, VLSI and Embedded Systems, Biomedical Technologies, Materials and Manufacturing, Energy and Sustainable Technologies, and other emerging areas of intelligent and advanced technology**.

The response to the call for abstracts has been encouraging, reflecting the growing interest of the academic and research community in emerging technologies and their applications. The accepted contributions included in these proceedings represent diverse perspectives, innovative methodologies, theoretical investigations, and application-oriented research. We hope that this collection will serve as a useful reference for researchers and practitioners and encourage further research, collaboration, and interdisciplinary exploration.

We express our sincere gratitude to the **General Chairs, Organizing Chair, Organizing Secretary, Finance Chair, Publication Chair, Technical Program Committee, reviewers, session chairs, coordinators, keynote and invited speakers**, and all members of the organizing team for their valuable time, guidance, and dedicated efforts in making ICICET 2026 possible.

We extend our **special thanks to Aspinotech Infosolutions Pvt. Ltd.** for hosting and organizing the conference and for providing the institutional and organizational support essential for its successful execution. We also gratefully acknowledge the support and association of **Seacom Skills University**, whose facilities and cooperation have contributed significantly to the successful conduct of the conference.

Finally, we sincerely thank all the **authors, presenters, delegates, speakers, and participants from India and abroad** for their valuable contributions and enthusiastic participation. Their research contributions and academic engagement are the foundation of this conference.

We hope that the ideas and research presented through **ICICET 2026** will inspire meaningful collaborations, stimulate new directions of inquiry, and contribute to technological advancement and societal progress.

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CONFERENCE SCHEDULE

Day 1: 22.08.2026

Venue: Offline: Seacom Skills University

Online: Google Meet , Time Zone: Asia/Kolkata

Date	*Time*	*Event*
22.08.2026	09:00 AM to 10:00 AM	Registration (For In-person participants only)
22.08.2026	10:00 AM to 11:00 AM	Inaugural Function Venue: Seacom Conference Hall Link: https://meet.google.com/qkm-tyvf-urh
22.08.2026	11:00 AM to 12:00 PM	Award Distribution Ceremony Venue: Seacom Conference Hall Link: https://meet.google.com/nud-fpqm-vhq
22.08.2026	12:00 AM to 12:30 PM	High Tea
22.08.2026	12:30 AM to 1:00 PM	Keynote Session Speaker:Prof. Rudra Sankar Dhar NIT Mizoram, India Venue: Seacom Conference Hall Link: https://meet.google.com/cus-gwxk-qsn
22.08.2026	1:00 AM to 1:30 PM	Keynote Session Speaker:Prof. Hatem Ksibi Sfax University, IPEIS Venue: Seacom Conference Hall Link: https://meet.google.com/cus-gwxk-qsn
22.08.2026	1:30 PM to 2:30 PM	Lunch
22.08.2026	2:30 PM to 3:30 PM	Panel Discussion Topic: Bridging Academia and Industry Through Emerging Technologies: Building a Future-Ready Workforce Venue: Seacom Conference Hall Link: https://meet.google.com/gxo-rkre-vzs
22.08.2026	2:00 PM to 3:30 PM	Technical Session 1 (Physical) Venue: Seacom Seminar Hall
22.08.2026	2:00 PM to 3:30 PM	Technical Session 2 (Virtual) Link: https://meet.google.com/tdi-nemr-kdw
22.08.2026	2:00 PM to 3:30 PM	Technical Session 3 (Virtual) Link: https://meet.google.com/rhd-tttt-eod
22.08.2026	2:00 PM to 3:30 PM	Technical Session 4 (Virtual) Link: https://meet.google.com/jbf-hybj-qyi
22.08.2026	3:30 PM to 3:45 PM	Tae Break
22.08.2026	3:45 PM to 4:00 PM	Valedictory & Felicitation Ceremony

Technical Session 1 (Physical)			
Sl	*Abstract Id*	*Speaker Name*	*Category*
1	ICICET26IS2009T21	Dr. Umalaxmi Thingujam	Invited Speaker
2	ICICET26IS2015T2	Ms. Anusruti Mitra	Invited Speaker
3	ICICET26IS2018T9	Dr. Senjuti Khanra	Invited Speaker

4	ICICET26IS2055T13	Dr. Nirmala Devi	Invited Speaker
5	ICICET26IS2022T20	Dr. Vamshi Mugu, MD, MS.	Invited Speaker
6	ICICET26SP1063T7	Mr. Dhrubajyoti Banerjee	Speaker
7	ICICET26SP1121T23	Ms. Sudipta Pal	Speaker
Technical Session 2 (Virtual)			
Sl	***Abstract Id***	***Speaker Name***	***Category***
1	ICICET26IS2012T1	Dr.G.Prasanna Lakshmi	Invited Speaker
2	ICICET26IS3001T2	Mr. Nirmal Kumar Jingar	Invited Speaker
3	ICICET26IS2042T1	Ms. Bitra Eswaramma	Invited Speaker
4	ICICET26IS2052T1	Dr.R.V.S.Lalitha	Invited Speaker
5	ICICET26SP1004T2	Mr. Sarthak	Speaker
6	ICICET26SP1006T2	Ms. Mandadi Siri	Speaker
7	ICICET26SP1007T2	Ms. Surbhi Tyagi	Speaker
8	ICICET26SP1010T2	Ms. Sneha Bondugula	Speaker
9	ICICET26SP1086T2	Ankita Chatterjee	Speaker
10	ICICET26SP1087T2	Piyanshu Makhal	Speaker
Technical Session 3 (Virtual)			
Sl	***Abstract Id***	***Speaker Name***	***Category***
1	ICICET26IS2021T6	Dr. Pranita Manish Potey	Invited Speaker
2	ICICET26IS2023T6	Dr. Swati Vaid	Invited Speaker
3	ICICET26IS2029T6	Ms. Suranjana Banerjee	Invited Speaker
4	ICICET26SP1079T5	Ms. Rumila Nandy	Speaker
5	ICICET26SP1081T5	Mr. Soumyajit Banerjee	Speaker
6	ICICET26SP1082T5	Ms. Misa Haldar	Speaker
7	ICICET26SP1084T5	Mr. Adwitiyo Bera	Speaker
8	ICICET26SP1001T6	Ms. Anushka Nandan	Speaker

Technical Session 4 (Virtual)			
Sl	***Abstract Id***	***Speaker Name***	***Category***
1	ICICET26IS2014T12	Ms. Dorota Korte	Invited Speaker
2	ICICET26IS2034T12	Mr. Soumojit Dasgupta	Invited Speaker
3	ICICET26IS2049T12	Dr. Lokendra P. Singh	Invited Speaker
4	ICICET26IS2059T12	Dr. Manisha Chaudhary	Invited Speaker
5	ICICET26SP1039T11	Mr. Shakti Prasad Mishra	Speaker
6	ICICET26IS2035T13	Dr. Manisha Patni	Invited Speaker
7	ICICET26IS2047T14	Ms. Divya Jyoti	Invited Speaker

Day 2: 23.08.2026

Online: Google Meet, Time Zone: Asia/Kolkata

Date	*Time*	*Event*
23.08.2026	10:00 AM to 11:30 AM	Technical Session 5 (Virtual) Link: https://meet.google.com/zuy-caxr-ntd
23.08.2026	10:00 AM to 11:30 AM	Technical Session 6 (Virtual) Link: https://meet.google.com/ykh-esfh-vrp
23.08.2026	10:00 AM to 11:30 AM	Technical Session 7 (Virtual) Link: https://meet.google.com/xfx-rgxk-npw
23.08.2026	12:00 PM to 1:30 PM	Technical Session 8 (Virtual) Link: https://meet.google.com/eep-nvkk-jrf
23.08.2026	12:00 PM to 1:30 PM	Technical Session 9 (Virtual) Link: https://meet.google.com/kcx-zxpq-qmx
23.08.2026	12:00 PM to 1:30 PM	Technical Session 10 (Virtual) Link: https://meet.google.com/dpa-xysh-fni
23.08.2026	2:00 PM to 3:30 PM	Technical Session 11 (Virtual) Link: https://meet.google.com/exr-kean-gbf
23.08.2026	2:00 PM to 3:30 PM	Technical Session 12 (Virtual) Link: https://meet.google.com/riv-ccvv-asx
23.08.2026	2:00 PM to 3:30 PM	Technical Session 13 (Virtual) Link: https://meet.google.com/jgg-mpxu-asf

Technical Session 5 (Virtual)			
Sl	*Abstract Id*	*Speaker Name*	*Category*
1	ICICET26IS2004T20	Dr. Abhishek Kumar	Invited Speaker
2	ICICET26IS2008T2	Ms. Jofia Jose Prakash	Invited Speaker
3	ICICET26IS2011T2	Dr. Pinakpani Mukherjee	Invited Speaker
4	ICICET26IS2013T2	Dr. Rijhi Dey	Invited Speaker
5	ICICET26SP1024T2	Mr. Krishan Kumar L	Speaker
6	ICICET26SP1043T2	Ms. Sudipta Sarkar	Speaker
7	ICICET26SP1050T2	Mr. Muthupandimani A	Speaker
8	ICICET26SP1055T2	Mr. Manoj Kumar Srivastav	Speaker
9	ICICET26SP1090T2	Rajaul Ansary	Speaker
10	ICICET26SP1094T2	Partha Chakraborty	Speaker
11	ICICET26SP1095T2	Jit Dutta	Speaker

Technical Session 6 (Virtual)			
Sl	*Abstract Id*	*Speaker Name*	*Category*
1	ICICET26IS2060T7	Prof. Adhir Baran Chattopadhyay	Invited Speaker
2	ICICET26IS2063T7	Dr. Meziane KACI	Invited Speaker
3	ICICET26SP1026T6	Ms. Pandiri Poojitha	Speaker
4	ICICET26SP1044T7	Mr. Supratim Mondal	Speaker
5	ICICET26SP1045T6	Mr. Soumendra Pain	Speaker
6	ICICET26SP1047T7	Mr. A Hriizhiio	Speaker
7	ICICET26SP1059T7	Mrs. Sananda Biswas	Speaker

8	ICICET26SP1123T6	Mr. Paramanand Sharma	Speaker
9	ICICET26SP1091T8	Sandip Karmakar	Speaker
10	ICICET26SP1093T8	Sayak Debnath	Speaker
Technical Session 7 (Virtual)			
Sl	***Abstract Id***	***Speaker Name***	***Category***
1	ICICET26IS2038T16	Dr. Anjali Rawani	Invited Speaker
2	ICICET26IS2046T15	Dr. Saswata Halder	Invited Speaker
3	ICICET26IS2048T14	Dr. Susmita Singh	Invited Speaker
4	ICICET26IS2051T14	Dr. Sushmita Chaudhari	Invited Speaker
5	ICICET26IS2066T17	Dr. Sayantan Guha	Invited Speaker
6	ICICET26SP1003T17	Mr. Lokenath Roy	Speaker
7	ICICET26SP1035T19	Mr. Rajit SR	Speaker
8	ICICET26SP1092T5	Dibyajit Das	Speaker
Technical Session 8 (Virtual)			
Sl	***Abstract Id***	***Speaker Name***	***Category***
1	ICICET26IS2025T2	Dr. Pritam Chakraborty	Invited Speaker
2	ICICET26IS2027T2	Dr. Dipankar Das	Invited Speaker
3	ICICET26IS2043T2	Mr. Suman Haldar	Invited Speaker
4	ICICET26IS2062T2	Mr. Chandrashekar Gudada	Invited Speaker
5	ICICET26SP1077T2	Ms. Mitali Jawa	Speaker
6	ICICET26SP1108T2	Ms. Sakshi Yadav	Speaker
7	ICICET26SP1018T3	Ms. Anshika Srivastav	Speaker
8	ICICET26SP1120T2	Ms. Ștefania-Alina MORARU	Speaker
9	ICICET26SP1088T3	Deblina Mandal	Speaker
10	ICICET26SP1088T3	Bijaya Mondal	Speaker
Technical Session 9 (Virtual)			
Sl	***Abstract Id***	***Speaker Name***	***Category***
1	ICICET26IS2033T10	Dr. Pragya Sinha	Invited Speaker
2	ICICET26IS2040T9	Dr. Pritha Banerjee	Invited Speaker
3	ICICET26IS2054T9	Dr. Mansi Sharma	Invited Speaker
4	ICICET26SP1122T14	Ms. Akanksha Verma	Speaker
5	ICICET26SP1103T7	Mr. Barun Nandi	Speaker
6	ICICET26SP1106T7	Mr. Prathmesh P. Mayekar	Speaker
7	ICICET26SP1109T7	Mr. Nourddine Ghelem	Speaker
8	ICICET26SP1111T7	Mr. Nourddine Ghelem	Speaker
Technical Session 10 (Virtual)			
Sl	***Abstract Id***	***Speaker Name***	***Category***
1	ICICET26IS2030T20	Dr. Rania Indu	Invited Speaker
2	ICICET26IS2031T20	Dr Devika Menon M K	Invited Speaker
3	ICICET26IS2045T20	Mr. Khakon Das	Invited Speaker

4	ICICET26SP1104T21	Mr. Debjit Roy	Speaker
5	ICICET26SP1105T20	Ms. Ekarna Chakraborty	Speaker
6	ICICET26SP1072T6	Mr. Sudip Pan	Speaker
7	ICICET26SP1083T7	Mr. Sourav Kar	Speaker
8	ICICET26SP1116T7	Mr. Hassane EZZIANE	Speaker
Technical Session 11 (Virtual)			
Sl	***Abstract Id***	***Speaker Name***	***Category***
1	ICICET26IS2017T4	Mr. Sajal Chakraborty	Invited Speaker
2	ICICET26IS2026T3	Dr. Prasun Chowdhury	Invited Speaker
3	ICICET26SP1057T3	Mr. Devdipro Bhaduri	Speaker
4	ICICET26SP1074T3	Ms. Shwetha S	Speaker
5	ICICET26SP1117T3	Mr. Ritankar Roy	Speaker
6	ICICET26SP1118T3	Mr. Prasun Dey	Speaker
7	ICICET26SP1119T3	Ms. Elena-Camelia MORARU	Speaker
8	ICICET26SP1020T4	Ms. B. Soumya Sri	Speaker
Technical Session 12 (Virtual)			
Sl	***Abstract Id***	***Speaker Name***	***Category***
1	ICICET26IS2028T11	Dr. Pragya Pandey	Invited Speaker
2	ICICET26IS2032T11	Dr. Debasish Majumder	Invited Speaker
3	ICICET26IS2036T11	Dr. Salam Kiranmala Chanu	Invited Speaker
4	ICICET26IS2050T11	Ms. Jyoti Sharma	Invited Speaker
5	ICICET26IS2053T11	Prof. Nahid Fatima	Invited Speaker
6	ICICET26SP1021T8	Ms. Shreeja Dey	Speaker
7	ICICET26SP1107T8	Mr. Shivam Raj	Speaker
8	ICICET26SP1041T4	Ms. Aswathy S V	Speaker
Technical Session 13 (Virtual)			
Sl	***Abstract Id***	***Speaker Name***	***Category***
1	ICICET26IS2005T18	Dr. Aminur Khan	Invited Speaker
2	ICICET26IS2007T21	Dr. Yukti Verma	Invited Speaker
3	ICICET26IS2016T22	Dr Anjali Singh	Invited Speaker
4	ICICET26SP1002T21	Ms. Jyothi Harshini Mogatadakala	Speaker
5	ICICET26SP1032T20	Dr. Dhirendra Sahoo	Invited Speaker
6	ICICET26SP1099T22	Mr. Manoj Kumar Srivastav	Speaker
7	ICICET26SP1110T21	Mr. Nourddine Ghelem	Speaker
8	ICICET26IS2070T2	Mr. Jyotipriyo Khanra	Invited Speaker
9	ICICET26SP1061T19	Mr. Subhajit Jana	Speaker

MESSAGE

Professor Dr. Arabinda Das

Electrical Engineering Department
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arabinda.das@jadavpuruniversity.in

It is a matter of immense pleasure and privilege to convey my warmest greetings and best wishes to the Organizing Committee, distinguished guests, eminent speakers, and delegates of the International Conference on Intelligent Computing and Emerging Technologies (ICICET 2026), hosted in hybrid mode at Bolpur, Shantiniketan, West Bengal, India.

We are living through an era of unprecedented technological transformation, where intelligent computing has transitioned from a specialized luxury to the fundamental engine of global progress. Emerging paradigms—such as Artificial Intelligence, machine learning, the Internet of Things, and advanced data analytics—are rapidly reshaping global industries, optimizing complex systems, and unlocking novel solutions to some of humanity's most pressing challenges. From pioneering breakthroughs in healthcare and advancing sustainable energy systems to revolutionizing the future of education, the societal impact of these fields is profound and far-reaching.

In this fluid and rapidly evolving landscape, the importance of rigorous academic inquiry and cross-border innovation cannot be overstated. Yet, technical excellence alone is no longer enough; solving the complex challenges of tomorrow demands a deeply ingrained culture of interdisciplinary collaboration. It is precisely at the intersection of diverse scientific domains that the most ground breaking ideas are born. Platforms like ICICET 2026 play a pivotal role in bridging the gap between academic research and industrial application, fostering meaningful dialogue, and inspiring researchers to translate theoretical frameworks into tangible, real-world solutions.

Shantiniketan, renowned for its rich cultural heritage and holistic philosophy of learning, serves as a deeply inspiring backdrop for this confluence of minds. I am confident that the scholarly deliberations, research presentations, and networking opportunities at this conference will spark innovative ideas and forge lasting international partnerships.

I highly commend the Organizing Committee for their meticulous planning and tireless dedication in bringing this prestigious event to fruition. I wish ICICET 2026 a resounding success and trust it will serve as a powerful catalyst for the advancement of intelligent computing and sustainable technology.

Arabinda Das
Arabinda Das
General Chair, ICICET 2026
August 22, 2026

MESSAGE

It is a matter of great pleasure to convey my warm greetings and best wishes to the organizers, distinguished speakers, researchers, academicians, industry professionals, and students participating in the International Conference on Intelligent Computing and Emerging Technologies (ICICET 2026).

We are living in an era where intelligent computing and digital transformation are redefining every sector of society. The emergence of Industry 4.0 has accelerated the adoption of artificial intelligence, the Internet of Things (IoT), cyber-physical systems, robotics, cloud computing, digital twins, and big data analytics, creating smarter industries and more resilient economies. Likewise, Education 4.0 is reshaping the learning ecosystem through personalized education, intelligent tutoring systems, virtual laboratories, and technology-enabled collaborative learning, preparing future generations for an increasingly digital world.

The challenges of the twenty-first century demand interdisciplinary collaboration, ethical innovation, and responsible technological development. Conferences such as ICICET 2026 provide an excellent platform for researchers, innovators, policymakers, and industry leaders to exchange ideas, foster collaborations, and develop intelligent solutions for addressing global challenges in healthcare, energy, environmental sustainability, smart cities, transportation, and digital governance.

I extend my best wishes for the grand success of ICICET 2026 and hope that the conference will contribute significantly to advancing knowledge, fostering innovation, and building a sustainable, intelligent, and inclusive future.

Arindam Biswas

Dr. Arindam Biwas
Associate Professor & Coordinator
Centre for IoT and AI Integration with Education-Industry-Agriculture
Kazi Nazrul University, Asansol

MESSAGE

On behalf of the entire organizing committee, I would like to take this opportunity and welcome you all to the **International Conference on Intelligent Computing and Emerging Technologies (ICICET 2026)** to be held on 22-23h August 2026 in Hybrid Mode at Bolpur, Shantiniketan, West Bengal, India. Serving as the Organizing Chair of ICICET 2026, I feel the immense significance of opportunities that serve as an auspicious moment for budding researchers, academicians and industrialists to come up with fresh and revolutionary ideas to address current concerns. The young researchers would highly benefit from the profound knowledge of the experts and for the sagacious delegates this serves as an opportunity to witness the unencumbered imagination of fledging researchers. We are grateful to the technical program committee members and other reviewers who put forward their efforts in recruiting the abstracts, reviewing the submissions, and made valuable remarks that helped in enriching the quality of the conference. I would further like to appreciate the persistent support from the organizing committee and inconspicuous contributions from several other members who have conjointly made this conference a grand success.

I feel grateful on behalf of the organization team and would like to thank our formidable organizer Aspinotech Infosolutions Pvt. Ltd., Kolkata, for organizing this conference in hybrid mode without which the conference would not have happened. Their vision and initiative to organize this conference has been the most important part, which has helped to sponsor and support this conference. So a big 'Thank you' to them.

I would extend my gratitude to all the Keynote speakers and luminaries who along with their busy schedules have taken out time and agreed to attend and present a part of their research views at the International Conference ICICET 2026. I hope your presence will serve as an inspiration to the nascent minds of the scientific community and make this conference a grand success.

Last but not the least I would like to extend my thanks to dear students and researchers who have submitted their abstracts and will be presenting and attending the upcoming 2 days and who waited for the conference to happen patiently. I hope you all will acquire the knowledge and expertise from the conference ICICET 2026 making the conference a grand success.

Entwined with the lingering charm of a novel concept of a hybrid conference, I hope this conference serves to be an enriching and delightful experience.

Prof. (Dr.) Rudra Sankar Dhar
Professor of Electronics
National Institute of Technology Mizoram
Organizing Chair
ICICET 2026

MESSAGE

It is my great pleasure to welcome all distinguished keynote speakers, invited speakers, speakers, awardees, researchers, academicians, industry professionals, and students from across the globe to the **International Conference on Intelligent Computing and Emerging Technologies (ICICET 2026)**. It is truly an honour to bring together such a diverse and accomplished community to exchange ideas, foster collaboration, and explore the latest advances in intelligent computing and emerging technologies.

As the **Technical Program Committee Chair**, I am delighted by the overwhelming response received from contributors worldwide. The technical program reflects a broad spectrum of innovative research spanning artificial intelligence, machine learning, communication systems, robotics, the Internet of Things, cybersecurity, sustainable technologies, and other interdisciplinary domains. Every accepted contribution has undergone a rigorous peer-review process to ensure high standards of originality, technical quality, and scientific significance.

ICICET 2026 provides an excellent platform for researchers, educators, innovators, and industry experts to share knowledge, discuss emerging challenges, and establish collaborations that will shape the future of science and technology. I am confident that the keynote lectures, invited talks, technical sessions, and discussions will inspire new ideas and foster enduring academic and industrial partnerships.

I extend my sincere gratitude to our **General Chairs, Organizing Chair, Organizing Secretary, Finance Chair, and Publication Chair** for their exemplary leadership and unwavering support in making ICICET 2026 a reality. I also express my heartfelt appreciation to the **Technical Program Committee members, reviewers, Advisory Board, session chairs, volunteers, authors, and participants** for their invaluable contributions. A special note of thanks goes to **Aspinotech Infosolutions Pvt. Ltd.** for successfully hosting and organizing this prestigious international conference and for providing a vibrant platform for global knowledge exchange.

I wish all participants a productive, inspiring, and memorable ICICET 2026, filled with insightful discussions, meaningful collaborations, and continued success in their research and professional endeavours.

Dr. Sumanta Bhattacharyya
Technical Program Committee Chair
ICICET 2026
International Conference on Intelligent Computing and Emerging Technologies

MESSAGE

It is my great pleasure and privilege to welcome you to the **International Conference on Intelligent Computing and Emerging Technologies (ICICET 2026)**. On behalf of the Organizing Committee, I extend a warm welcome to all participants from around the world who have joined us to share their knowledge, innovative ideas, and research outcomes in the rapidly evolving fields of intelligent computing and emerging technologies.

As the Publication Chair, my foremost responsibility is to ensure that the conference maintains the highest standards of academic integrity, technical excellence, and publication quality. Every submitted manuscript undergoes a rigorous peer-review process conducted by eminent experts in the respective domains. Our objective is to publish original, high-quality, and impactful research that contributes significantly to scientific advancement and technological innovation. Selected papers will have the opportunity to be considered for publication in reputed Scopus-indexed journals, edited books, and special issues, subject to the quality and scope of the research.

I sincerely encourage all participants to actively engage in the keynote lectures, technical sessions, poster presentations, panel discussions, and networking opportunities throughout the conference. I am confident that your participation will lead to meaningful academic interactions, new research collaborations, and valuable professional connections that extend well beyond this event.

I would like to express my heartfelt gratitude to the Advisory Committee, Technical Program Committee, Reviewers, Session Chairs, Organizing Committee Members, Keynote Speakers, Sponsors, and all authors and participants whose dedicated efforts have made ICICET 2026 possible. Their commitment to academic excellence and collaborative research is the cornerstone of this conference's success.

I wish every participant a productive, enriching, and memorable conference experience. May ICICET 2026 serve as a catalyst for innovative research, interdisciplinary collaboration, and technological advancements that will benefit society and contribute to a sustainable future.

Thank you for your participation, and I wish you a successful and inspiring conference.

With best regards,

Bidrohi Bhattacharjee

Dr. Bidrohi Bhattacharjee
Publication Chair, ICICET 2026
Head of the Department & Associate Professor
Department of Electrical Engineering
Budge Budge Institute of Technology (BBIT), Kolkata, India

MESSAGE

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Message

It is my great pleasure and honour to extend my warmest greetings and best wishes to all distinguished guests, keynote speakers, academicians, researchers, industry professionals, and participants of the **International Conference on Intelligent Computing and Emerging Technologies (ICICET)-2026**.

ICICET-2026 is envisioned as a platform that brings together innovative minds, meaningful research, emerging ideas, and strong academia–industry collaboration. I sincerely hope that this conference will inspire new possibilities, encourage knowledge exchange, and create lasting professional and research connections.

I would like to express my heartfelt gratitude to **Seacom Skills University** for its valuable association and support in making ICICET-2026 possible. I also extend my sincere thanks to all speakers, reviewers, session chairs, participants, volunteers, and members of the organizing team for their valuable contributions.

As the **Conference Secretary and Founder Director of Aspinotech Infosolutions Private Limited**, I am proud to welcome you all to ICICET-2026 and wish the conference every success in advancing research, innovation, and emerging technologies.

With best wishes,

Mr. Bijoy Pal
Conference Secretary & Founder Director
Aspinotech Infosolutions Private Limited

MESSAGE

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Message

It is my great pleasure to extend my warmest greetings and heartfelt good wishes to all distinguished guests, keynote speakers, academicians, researchers, industry professionals, and participants of the **International Conference on Intelligent Computing and Emerging Technologies (ICICET)-2026**.

ICICET-2026 is a significant initiative to bring together researchers, innovators, academicians, and industry professionals on a common platform for sharing knowledge, exchanging ideas, and exploring the transformative potential of intelligent computing and emerging technologies. I am confident that this conference will foster meaningful collaboration, encourage innovative research, and contribute to building a smarter and future-ready world.

I sincerely express my gratitude to **Seacom Skills University** for its valuable association and support. I also extend my appreciation to all distinguished speakers, reviewers, session chairs, participants, volunteers, and members of the organizing team whose dedication and contributions have made this conference possible.

As **CEO-Director of Aspinotech Infosolutions Private Limited**, I am honoured to welcome you all to ICICET-2026 and wish the conference great success. May this conference create new opportunities for collaboration, innovation, research, and knowledge exchange.

With warm regards and best wishes,

Mr. Shirshendu Pandit
CEO-Director
Aspinotech Infosolutions Private Limited

MESSAGE

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To Whom It May Concern

I am delighted to convey my warm greetings and best wishes on the occasion of the International Conference on Intelligent Computing & Emerging Technologies (ICICET)–2026.

Conferences such as ICICET provide an invaluable platform for bringing together scholars, academicians, researchers, industry experts, and young minds to exchange ideas, explore emerging possibilities, and shape the future of technology.

I am confident that the deliberations and collaborations emerging from this conference will contribute meaningfully to innovation, research, and societal transformation.

My best wishes for a successful, enriching, and impactful ICICET–2026.

Shri Arpon Chakroborty
Chief Executive Officer
Seacom Group

MESSAGE OF FINANCE CHANCELLOR
SMT. SUMITA CHAKROBORTY

SEACOM SKILLS UNIVERSITY

To Whom It May Concern

It gives me immense pleasure to extend my heartfelt best wishes for the successful organization of the International Conference on Intelligent Computing & Emerging Technologies (ICICET)–2026.

May this conference serve as a vibrant platform for knowledge exchange, innovation, research, and meaningful collaboration, inspiring new ideas and contributing to the advancement of emerging technologies.

Wishing ICICET–2026 great success and a lasting impact.

Best Wishes

Smt. Sumita Chakrobortry
Chancellor
Seacom Skills University

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CONTENTS

KEYNOTES

Integrating Green Extraction, Solubility Modeling, and AI for Bioactive Compound Recovery

Prof. (Dr.) Hatem Ksibi
Professor in Chemical Engineering, Engineer in Mechanics

The valorization of plant-derived bioactive compounds has become a major challenge for pharmaceutical, nutraceutical, cosmetic, and food industries. The development of sustainable extraction processes requires not only high extraction yields but also the production of purified extracts while minimizing energy consumption, solvent use, and operational costs. However, identifying optimal extraction conditions remains challenging due to the complex nonlinear relationships between plant matrix characteristics, molecular properties, solvent interactions, and operating parameters. This review highlights the central role of predictive modeling, artificial intelligence (AI), and machine learning (ML) in the design and optimization of advanced extraction strategies. Conventional and green extraction technologies, including supercritical fluid extraction, pressurized liquid extraction, ultrasound-assisted extraction, microwave-assisted extraction, and hybrid approaches, are briefly discussed as process frameworks. Particular emphasis is placed on solubility and extraction performance prediction using empirical correlations (Apelblat, Chrastil, Bartle, and Kumar–Johnston), thermodynamic models, equations of state, and group contribution methods such as UNIFAC.

Applications involving diverse plant resources, including olive-derived phenolics, *Retama raetam*, flaxseed, and *Plantago* species, demonstrate the versatility of modeling approaches for predicting compound behavior and guiding process optimization. Advanced ML algorithms, such as Random Forest, eXtreme Gradient Boosting (XGBoost), Artificial Neural Networks, and Support Vector Machines, have shown superior capability in capturing complex nonlinear interactions between process variables, extraction yield, selectivity, and extract quality. The integration of experimental databases, physicochemical descriptors, molecular information, and physics-informed ML models enables multi-objective optimization strategies aimed at achieving the best compromise between high yield, enhanced purity, low energy consumption, and reduced processing costs. These AI-driven frameworks represent powerful tools for accelerating sustainable extraction development and supporting the transition toward intelligent biorefinery concepts.

Keywords: *Bioactive compounds; Green extraction technologies; Solubility modeling; Machine Learning; Multi-objective process optimization; Sustainable biorefinery.*

KEYNOTES

Emerging VLSI Technology and Nanodevices for Next Generation Systems

Prof. (Dr.) Rudra Sankar Dhar
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National Institute of Technology Mizoram, Aizawl, India

Incubating a novel technology of tri-layered channel system with strained Si surrounding the SiGe layer to form Heterostructure on Insulator (HOI) based n-channel Nano FET is the pursuit. Scaling such structures down to 10 and 08 nm channel length subduing the SCEs having punchthorugh effect, channel length modulation, subthreshold swing and DIBL are the main challenges in the Nanodevices for developing FinFETs and NW GAA FETs. 10nm gate length strained-channel CGAA, featuring a tri-layered structure of s-Si and s-SiGe, demonstrates a 20% enhancement in on-current over 22nm strained CGAA, a 57% improvement over Si only CGAA, and a 75% increase over the IRDS 2022 3nm technology node establishing itself as the as a highly efficient and advanced nano-regime device. These devices use a strain engineering-based quantum well barrier system in the channel region, highk spacers sandwiching the underlaps, and a high-k gate-oxide stack to effectively control leakages and short-channel effects through high-k (HfO2) spacers. Further, on incorporating tungsten metal gates in the NW CGAA demonstrates a 98.18% reduction in off-current and 22.5% increase in on-current compared to existing high-k spacer-based CGAA FETs. The output performance (ID-VDS) of this novel device reveals substantial improvements over existing GAA FETs, aligning with IRDS 2028 1nm technology node criteria. The Type-II heterostructure band alignment in the ultra-thin cylindrical channel induces quantum well barrier mechanisms, creating an electrostatic charge centroid and leading to energy band bending and splitting among the strained silicon layer's valleys, significantly enhancing electron mobility, current density, and electron velocity in the channel, thus promoting oncurrent enhancement via ballistic transport of carriers. These advancements position the strained channel nanowire CGAA FET as a future-forward device for digital, RF applications, and faster switching speeds.

INTELLIGENT COMPUTING & ALGORITHMS

ICICET26IS2012T1

Clinically Validated AI-Driven Intelligent Computing for Wearable Based Health Monitoring in Elderly Populations

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ABSTRACT
The research proposal focuses on an AI-driven intelligent computing framework for wearable-based health monitoring in elderly populations, emphasizing clinical validation, reliability, and real-world impact. The system integrates smart wearable's, machine learning, and cloud analytics to continuously monitor physiological parameters such as heart rate, physical activity, posture, and vital signals. This enables early detection of falls, health deterioration, and progression of chronic diseases.
The proposed framework was evaluated through a forward-looking, multi-site clinical study involving elderly individuals in both independent and assisted living environments. The findings demonstrated a significant reduction in hospitalizations and fall incidents compared to control groups. By leveraging advanced technologies such as explainable AI, federated learning, and edge computing, the framework bridges the gap between cutting-edge artificial intelligence and scalable digital healthcare solutions tailored for aging populations.
The system combines wearable sensors with edge-enabled intelligent computing to capture real-time data, including heart rate variability, sleep patterns, and activity levels. Hybrid deep learning models enable anomaly detection, predictive risk assessment, and personalized health recommendations. The incorporation of explainable AI enhances transparency, interpretability, and clinical trust.
To ensure real-world applicability, the framework will undergo extensive validation in clinical settings, focusing on critical elderly health concerns such as cardiovascular risks, fall detection, and cognitive decline. The system is designed to be user-friendly, energy-efficient, secure, and privacy-preserving using IoT technologies.
Expected outcomes include scalable real-time monitoring, early risk alerts, improved quality of life, reduced healthcare burden, and alignment with national digital health priorities.

Keywords: *Wearable based health monitoring; elderly population; clinical validation; artificial intelligence in healthcare; intelligent computing; edge computing; machine learning; deep learning; fall prediction; early deterioration detection; explainable AI; federated learning; remote patient monitorin*

ICICET26IS2042T1

Restoration and Image Quality Enhancement Distorted Tribal Art Images Using Cuckoo Search Optimization

Bitra Eswaramma[1], Rudra Sankar Dhar[2], Manoj Kumar Dutta[3]
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[3]Department of Physics BIT Mesra

ABSTRACT
Tribal art represents valuable cultural heritage but is highly vulnerable to degradation due to fragile materials and environmental factors such as light, moisture, and pollutants. Traditional image enhancement methods, such as histogram equalization, often lead to over-enhancement and loss of fine details. This paper proposes a color image enhancement method using the Cuckoo Search (CS) algorithm with histogram optimization and smoothness constraints to restore deteriorated tribal paintings. The

method formulates enhancement as an optimization problem, where optimal histogram distributions for each RGB channel are obtained using Levy flight–based search and iterative refinement. A composite objective function ensures a balance between contrast improvement, brightness preservation, and smooth intensity transitions. Performance is evaluated using PSNR, AMBE, NMSE, CPP, and EME. Experimental results demonstrate that the proposed approach significantly improves visual quality and outperforms traditional histogram equalization methods in terms of detail preservation, contrast enhancement, and reduced artifacts.

ICICET26IS2052T1

Quantum-Enhanced Machine Learning for Real-Time Video Object Detection

R.V.S.Lalitha

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ABSTRACT

This paper introduces a Quantum-Enhanced Machine Learning for Real-Time Video Object Detection framework built specifically for unpredictable and fast-changing video streams. By combining quantum and classical computing, we add a parameterized quantum circuit (PQC) directly into the model's feature extraction pipeline. This allows the system to process complex video data in parallel. Our approach converts regular video frames into quantum states using amplitude encoding, creating a stronger feature representation that naturally resists environmental noise and erratic object movements. Integrating quantum computing with classical systems allows for dynamic analysis by leveraging the strengths of both paradigms. This hybrid approach significantly increases predictive precision and enables the efficient processing of massive datasets. In this paper, we evaluate the performance of quantum algorithms relative to their classical counterparts to demonstrate their potential advantages.

Keywords: *Classification algorithms; encoding techniques; Parameterized Quantum Circuit; QML.*

ARTIFICIAL INTELLIGENCE, MACHINE LEARNING & COMPUTER VISION

ICICET26IS3001T2

Deterministic and Governed AI Architectures for Enterprise-Scale Intelligent Systems

Nirmal Kumar Jingar
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ABSTRACT
Artificial intelligence systems are rapidly moving from experimental pilots to mission-critical enterprise infrastructure. As AI adoption expands, organizations face growing challenges around reliability, accountability, risk management, and decision ownership. This talk explores deterministic and governed AI architectures designed for enterprise-scale intelligent systems.
The presentation introduces architectural principles that enable predictable behavior, traceability, and human oversight across AI-driven workflows. It examines how governance layers, policy enforcement mechanisms, model monitoring frameworks, and feedback loops can be integrated into cloud-native and distributed environments. The focus is not only on model performance, but on system-level resilience, explainability, and operational control.
Drawing from real-world enterprise transformation initiatives, the session outlines repeatable design patterns for embedding AI into production systems while maintaining compliance, security, and business alignment. It also addresses executive-level considerations such as regulatory readiness, auditability, cross-functional ownership models, and measurable ROI. Attendees will gain practical insight into building AI systems that are not only intelligent, but trustworthy, scalable, economically viable, and sustainable in complex organizational settings.

ICICET26SP1086T2

Sanjeevani – AI-Enabled Smart Patient Monitoring and Emergency Alert System

Ankita Chatterjee, Bipasha Chakrabarti Banik, Sampa Das, Barun Mazumdar

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ABSTRACT
"Sanjeevani" is a simple and reliable smart healthcare system created to continuously monitor patients and provide instant emergency alerts, making it ideal for home care, elderly support, small clinics, and rural settings in India. Named after the mythical life-saving herb, it serves as a caring guardian that watches over the patient day and night. The system has two connected parts. A small wearable unit worn on the wrist checks body temperature, detects falls through movement, and includes an SOS button for urgent help. This data is sent wirelessly to the main monitoring unit near the bed. The main unit receives the wearable information and also monitors saline bottle level, bed presence, and room air quality. Key details show on a small color screen, with a status light turning green for normal and red for alerts. A buzzer sounds loudly during serious conditions like falls, SOS press, low saline, patient out of bed, or poor air. A red emergency stop button allows caregivers to silence the alarm after attending to the patient. A basic web page lets family or doctors view live readings on any phone or laptop connected to the same WiFi. Built with affordable, locally available parts, "Sanjeevani" offers continuous monitoring, quick alerts, easy alarm reset, and simple remote checking. It helps catch issues early, reduces constant manual watching, and supports safer, more peaceful patient care in everyday Indian homes and healthcare places.

ICICET26IS2008T2

Building Trustworthy Agentic AI Systems: Risks, Controls, And Governance Patterns

Jofia Jose Prakash
Member of the Board of Advisors, The American Council for Ethical AI, Washington, DC, USA

ABSTRACT
Agentic AI is re-writing the enterprise risk equation. Classic AI systems output predictions or generated content. Agentic systems can plan, retrieve, call tools, make choices at every step, and trigger real-world actions. That transition from response generation to delegated action opens up a new class of challenges for safety, security, accountability, and governance.
In this talk, I will argue that trustworthy agentic AI is not a problem to be solved at the model quality level, but at the system level. I will present a framework for building agentic systems that are by design bounded, observable, and governable. I will focus on the most important risk categories, including unsafe tool use, hallucinated action chains, outsized autonomy, data leakage, invisible reasoning failures, prompt-driven manipulations, and weak escalation paths. I will then map each risk to concrete control patterns including scoped permissions, policy checks, validation gates, human approval thresholds, decision logging, traceability, and continuous monitoring.
The overall objective of this talk is to move the researcher, architect, and practitioner from the question of whether an agent is intelligent to the far more important question of whether it can be trusted in real operational settings.

Keywords: *Agentic AI, Trustworthy AI; AI Governance; AI Risk Management; Autonomous Systems;*

ICICET26IS2011T2

A Review on Multivariate Regression Models or Predicting Bit Error Rate and Power Penalty in Optical Communication Networks

Pinakpani Mukherjee[1], Adrish Dowari[2], Ahan Bhattacharyya[3], Aranya Das[4], Chayanika Maity[5] and Astha Bose[6]

[1,2,3,4,5,6]*Department of Electronics & Communication Engineering, Academy of Technology, Hooghly, India*

ABSTRACT
Optical communication networks often face challenges related to signal integrity, including transmission impairments that directly affect bit error rate (BER) and power penalty, two significant performance metrics in optical communication systems. This review explores the role of multivariate regression models in predicting the aforementioned factors in optical communication networks, which is significant for meeting the demand for analytical models in optical communication system optimization. The role of machine learning in integrating regression models to predict optical communication system performance is also explored in the context of the interrelationships among modulation, coding, and impairments. Results show that multivariate regression models, especially when integrated with machine learning, provide significant improvements in BER and power penalty predictions. Nonetheless, certain challenges need to be addressed, especially those related to nonlinear impairments and scalability for real-time applications. The results of this paper underscore the need for a "hybrid" approach that provides a holistic overview of the state of affairs. The review provides a comprehensive overview of existing knowledge. Also, it identifies "white spaces" that need to be addressed, opening new avenues for research on adaptive and "intelligent" optical communication systems.

Keywords: *Optical communication networks, BER, power penalty, multivariate regression.*

ICICET26IS2013T2

Smart Healthcare Monitoring using Wearable IoMT Devices and Edge Computing

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ABSTRACT
The combination of the Internet of Medical Things (IoMT), edge computing, and wearable sensors creates an innovative method for monitoring health without interrupting the user's daily activities in real-time. Photoplethysmography (PPG), one type of sensor technology, can measure vital signs like heart rate, heart rate variability (HRV), blood pressure (BP), and respiratory rate. Challenges associated with PPG include reducing motion artifacts, designing algorithms that work efficiently on edge devices, and validating PPG's accuracy in a clinical setting. Research is also needed to develop accurate and non-invasive methods of measuring blood pressure and estimating glucose levels.
This research work presents the creation and implementation of an integrated IoMT-edge computing framework for reliable, multi-parameter physiological monitoring via wearable devices. The proposed system is designed modularly, incorporating not only the selection and optimization of wearable sensors but also the establishment of robust signal acquisition/pre-processing pipelines and the performance of edge-based algorithms for estimating glucose, heart rate variability (HRV), blood pressure (BP), and respiratory rates. This framework is characterized by low-latency processing at the edge (for real-time analytics), minimizing its reliance on cloud resources.
Artifact-resistant PPG signal processing pipeline, as well as edge-deployable predictive models and a fully-functioning wearable / prototype with a cloud-based dashboard. Addressing current gaps and allowing for scalable, efficient, and clinically relevant IoMT-based health care solutions.

Keywords: *Internet of Medical Things (IoMT); Edge Computing; Photoplethysmography (PPG); Real-Time Health Monitoring*

ICICET26SP1087T2

Smartroad Guardian – AI-Based Intelligent Vehicle Speed Control and Safety System

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ABSTRACT
In today's fast-moving world, transportation has become quicker, but road safety remains a serious concern. Overspeeding is one of the major causes of road accidents, especially in sensitive areas like schools, hospitals, and construction zones. To address this problem, this project proposes an AI-based smart vehicle speed control system using RFID, GPS, and an Arduino-based embedded platform. In this system, RFID tags are installed at the entry and exit points of speed-restricted zones. An RFID reader mounted inside the vehicle detects these tags and sends the data to the Arduino controller. Based on the detected location, the system automatically reduces the vehicle's speed by controlling the motor through a motor driver using Pulse Width Modulation (PWM). To improve reliability, a GPS module is integrated to continuously track the vehicle's position. With the help of AI-assisted geofencing, the system can identify restricted zones even if the RFID tag is missed due to high vehicle speed or signal limitations. The AI component can also analyze location data and adapt speed control more intelligently. This

combined use of RFID, GPS, and AI technology creates a smart and efficient system for automatic vehicle speed regulation, helping to improve road safety and reduce accidents in critical zones.

ICICET26SP1094T2

Truthguard AI – Machine Learning-Based Fake News Detection and Verification System

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ABSTRACT

The rapid growth of social media and online news platforms has significantly increased the spread of misinformation and fake news, which can mislead the public, influence opinions, and create social and political instability. Detecting fake news manually is difficult due to the enormous amount of content generated every day. Therefore, automated systems based on Machine Learning (ML) and Natural Language Processing (NLP) have become essential tools to identify and classify fake news efficiently. This study focuses on developing a machine learning-based approach to detect fake news by analyzing textual patterns and linguistic features in news articles. The proposed system uses supervised machine learning algorithms such as Logistic Regression and Support Vector Machines (SVM) to classify news articles as either real or fake. In the preprocessing stage, the news dataset undergoes several Natural Language Processing techniques, including text cleaning, tokenization, stop-word removal, stemming, and lemmatization, to convert raw textual data into a structured format. After preprocessing, TF-IDF (Term Frequency–Inverse Document Frequency) vectorization is applied to transform textual information into numerical feature vectors that machine learning models can process effectively. The models are trained and tested on labeled datasets containing both genuine and fake news articles. During the training phase, the algorithms learn distinguishing linguistic patterns, word distributions, and contextual indicators commonly present in fake news content. Performance evaluation is conducted using standard metrics such as accuracy, precision, recall, and F1-score to assess the effectiveness of each model. Experimental results indicate that machine learning models can achieve high classification accuracy, demonstrating their capability to detect fake news reliably. The proposed approach contributes to reducing the spread of misinformation by enabling automated identification of unreliable news sources. Such systems can assist social media platforms, news organizations, and fact-checking agencies in filtering misleading content and promoting trustworthy information. In the future, integrating deep learning techniques and real-time data analysis could further improve the performance and scalability of fake news detection systems.

Keywords: *ML, NLP, SVM, TF-IDF*

ICICET26IS2015T2

Understanding Of Human Reaction Based on Color Perception

Anusruti Mitra
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ABSTRACT
The correlation between color and human sentiment has gathered a huge amount of attention, particularly in the domain of psychological well-being. Colors are not just visual elements; they play an important role in the exchange of information by provoking mood, guiding behavior, and even creating a reason for measurable physiological changes. On the same page, machine learning has promptly changed as a dominant approach for exploring compound patterns across different domains. For ongoing research, we inspect how many various ways machine learning techniques have been applied to inquiry color psychology and human reaction on the same. Divergent models applied in previous probing are studied in detail to perceive their potential in detaining physiological responses associated with colors.

ICICET26SP1120T2

Evaluating Fairness and Explainability for Trustworthy Cardiovascular AI Prediction

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ABSTRACT
Integration of artificial intelligence in the diagnosis of cardiovascular disease is often marred by ethical challenges associated with algorithmic biases and the opaqueness of the highly complex predictive model. To address the disconnect between computational progress and clinical acceptability, the current study introduces and validates a two-fold Trustworthy AI model with emphasis placed solely on algorithmic fairness and XAI. With the use of a patient sample size of 70,000 records, an Optimized Random Forest classifier was designed to predict the presence of cardiovascular disease through comparison with the traditional Logistic Regression model and evaluated for demographic parity using SHapley Additive exPlanations (SHAP). The findings reveal that the proposed model can deliver global accuracy of 72.74%. With the help of statistical proof of only 0.67% ($p = 0.48$) Fairness Gap for female versus male patients, and virtually identical ROC curves, the model is able to mitigate the possibility of any discriminatory approach toward the particular group, thus supporting the basic rule of medicine non-

maleficence. Moreover, by the means of SHAP, the "black box" problem of the algorithm was eliminated; it provided visual and numeric evidence that the model does not use demographic variables, including gender, but uses only biological indicators, such as blood pressure and age. Thus, this study proves that effective algorithms can be also fair and medically explainable.

Keywords: *Trustworthy AI; Explainable AI (XAI); algorithmic fairness; cardiovascular disease prediction; SHAP*

ICICET26IS2004T2

Adaptive Local Fuzzy Histogram Equalization for Image Contrast Enhancement with Brightness Preservation

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ABSTRACT
Enhancing image contrast while preserving natural brightness remains a challenging problem in digital image processing, particularly for images captured under poor illumination or low dynamic range conditions. Conventional histogram equalization techniques often improve contrast at the expense of brightness distortion and loss of important visual details. To address these limitations, this work proposes an adaptive fuzzy histogram equalization framework that improves contrast while maintaining brightness consistency. The proposed method introduces an adaptive peak detection mechanism for identifying significant intensity peaks within the image histogram. Unlike conventional approaches that rely on fixed minimum and maximum peak selection, the adaptive strategy dynamically determines dominant peaks based on the distribution of pixel intensities. These peaks are then used to partition the histogram into meaningful regions, enabling controlled redistribution of pixel values while preserving the original brightness characteristics of the image. In addition, a local adaptive enhancement strategy is incorporated to handle images with non-uniform illumination. The input image is divided into smaller regions, and fuzzy histogram equalization is applied independently within each region. This localized processing allows the algorithm to effectively enhance contrast in both bright and dark areas while maintaining spatial consistency across the image. Experimental evaluation on a variety of grayscale and color images demonstrates that the proposed approach produces improved contrast enhancement and better brightness preservation compared to conventional global histogram equalization techniques. The results indicate that the adaptive and locally guided framework provides visually pleasing images with enhanced details, making it suitable for applications in medical imaging, remote sensing, and surveillance systems.

Keywords: *Contrast Enhancement; Histogram Equalization; Fuzzy Histogram; Image preprocessing.*

Contrast Enhancement; Histogram Equalization; Fuzzy Histogram; Image preprocessing.

ICICET26IS2025T2

A Nonlinear Recurrence-Based Computational Framework for Video-Derived Motion Time-Series Analysis

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ABSTRACT
Human motion analysis often relies on linear descriptors or black-box models that fail to capture intrinsic nonlinear dynamics. This paper proposes a nonlinear recurrence-based computational framework for analyzing motion time-series derived from video data. The approach models motion trajectories as outputs of an underlying dynamical system using time-delay embedding for state-space reconstruction. Recurrence quantification analysis (RQA) and finite-time Lyapunov exponent (FTLE) are employed to extract interpretable features representing determinism, complexity, and stability. A complete pipeline including preprocessing, embedding parameter estimation, and nonlinear feature extraction is developed for low-cost video-based signals. Experimental results on upper-limb motion demonstrate that nonlinear descriptors reveal structured dynamical patterns not captured by linear methods. The extracted features are stable across parameter variations and provide a compact representation suitable for intelligent systems. The framework enables scalable, explainable, and sensor-independent motion analysis for applications in artificial intelligence and time-series analytics.

Keywords: *Nonlinear Time Series; Recurrence Quantification Analysis; Phase-Space Reconstruction; Finite-Time Lyapunov Exponent; Motion Analysis*

ICICET26IS2062T2

Automated Diagnosis f Acute Lymphoblastic Leukemia using Pre-Trained CNNS and Feature-Optimized Machine Learning Classifiers on Blood Smear Images

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ABSTRACT
Acute Lymphoblastic Leukemia (ALL) is among the serious cases of cancer that may affect one's blood. It is a condition that can be experienced by both children and adults. Early diagnosis of ALL is critical for better management and survival of the patients. Manual detection of this blood disease via examination of blood smear images by haematologists is a time-consuming process. Automated methods have been proposed as a potential solution to replace manual procedures in the detection of ALL. In this paper, an automated system is proposed for detecting and classifying ALL by hybridizing deep learning feature extractor with conventional machine learning classifiers. First, the images are processed to remove any distortion and noise from the images. Deep discriminative features are then extracted using transfer

learning approach on the following six Convolutional Neural Network (CNN) models: VGG16, ResNet18, GoogLeNet, SqueezeNet, MobileNetV2, and AlexNet. To overcome feature redundancy and decrease computational cost, the obtained features are optimized by applying SelectKBest feature selection method based on ANOVA F-test. These extracted features are classified using five machine learning algorithms, namely Logistic Regression, Linear Regression, Decision Tree, Support Vector Machine, and Naive Bayes. The performance of the suggested model is evaluated by employing the publicly available dataset, that is ALL-IDB2, based on several parameters, including accuracy, precision, recall, F1-score, mean square error (MSE), ROC-AUC, and confusion matrix. Results from experimental evaluation have shown that the hybrid model of deep features and machine learning provides very high levels of diagnostic performance, which makes the proposed computer-aided system an efficient tool for diagnosing Acute Lymphoblastic Leukemia.

Keywords: *Acute Lymphoblastic Leukemia; ALL-IDB2; Blood Smear Images; Deep Learning; Feature Selection.*

ICICET26IS2027T2

An Intelligent Hybrid Machine Learning Framework for Forecasting Non-Linear Wholesale Price Indices of Basic Metal Commodities in India

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ABSTRACT

The prediction of commodity price indices is very important for economic planning, industrial policy, and inflation tracking. The basic metal sector is very sensitive among the various industrial sectors owing to its close association with manufacturing, infrastructure and construction. This research work proposes an intelligent hybrid machine learning-based approach for forecasting the non-linear Wholesale Price Indices (WPI) of basic metal commodities in India. The monthly WPI (base: 2011-12=100) data of forty-one commodities belonging to the manufacture of basic metals category were obtained from April 2012 to March 2017. First, curve fitting technique was used to find the commodities that show non-linear trends in their price movement, in which, fifteen indices were found to have significant non-linear trends. For these indices, a hybrid forecasting framework, comprising of three models (Autoregressive modelling (AR), Multilayer Perceptron neural network (MLP), and Support Vector Regression (SVR) was proposed. The proposed hybrid framework employed AR and MLP as initial forecasting learners, whereas SVR was employed to correct the residual fitting error and improve the forecasting performance. Weighted aggregation was carried out to produce the final forecast values. The forecasting accuracy of the hybrid model was measured for out-of-sample forecasting, 12 months ahead and compared with several benchmark models, including Automatic ARIMA, Automatic ETS, TBATS, Automatic MLP and Linear Regression. The results showed that the proposed AR-MLP-SVR hybrid model outperformed the benchmark models in most cases with lower RMSE, MAE, and MAPE values, for all fifteen non-linear WPIs. The research shows that intelligent hybridisation of statistical and machine learning models can lead to improved forecasting accuracy of non-linear economic time series. The proposed system provides a computationally efficient decision-making system for predicting future price movements of India's basic metals.

Keywords: *Hybrid Machine Learning; Intelligent Forecasting; Wholesale Price Index; Multilayer Perceptron; Support Vector Regression; Predictive Analytics; Basic Metal Commodities*

ICICET26IS2043T2

Physics-Informed Feature Engineering and Gradient Boosting for Traffic Congestion Classification in Electric Three-Wheelers

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ABSTRACT
This paper presents a physics-informed and machine learning framework for traffic congestion classification in Electric Three-Wheelers (E3Ws) using temporal battery and vehicle dynamic signals collected during real driving conditions. The proposed system identifies four traffic states — IDLE, SMOOTH, MODERATE, and HIGH congestion by analysing the electrical behaviour of the E3W battery under varying traffic loads. A sliding-window based feature engineering approach is employed to convert raw temporal battery signals into 34 statistical and physics-informed features representing load variation, transient acceleration behaviour, electrical stress, and energy consumption dynamics. The extracted features include RMS current, instantaneous power, transient current variation, Shannon entropy of current, voltage sag characteristics, battery-cell imbalance index, and normalised energy utilisation indicators related to vehicle drive-cycle behaviour. The engineered feature set is processed using a Gradient Boosting classifier to model nonlinear relationships between battery discharge patterns and traffic congestion conditions. Experimental results demonstrate a classification accuracy of 93.10%, along with effective evaluation through multiple performance metrics for robust model selection and validation. Confusion matrix analysis further confirms the effectiveness of the proposed framework in accurately distinguishing different congestion levels, with minor misclassification observed mainly between MODERATE and SMOOTH traffic states due to overlapping driving characteristics. The proposed framework demonstrates that physics-informed feature engineering combined with ensemble learning can provide an accurate, interpretable, and computationally efficient solution for intelligent traffic congestion analysis in IoT-enabled electric mobility systems.

Keywords: *Electric three-wheeler; Gradient boosting; Traffic congestion; Feature engineering*

ICICET26SP1004T2

Optimizing Large Language Model Integration: A Scalable Architecture for Real-Time Generative AI Applications

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ABSTRACT
The rapid growth of the Generative AI market, projected to reach USD 103.58 billion by 2025, has created a strong need for effective integration structures. However, current systems often encounter vendor lock-in. About 87% of businesses are limited to closed-source models like GPT-4, and there are serious security issues. Recent reports show that over 1.5 million API keys were exposed in client-side applications during one incident. To tackle these problems, this paper introduces NeuraGPT, a secure, multi-model generative AI platform based on the MERN stack (MongoDB, Express.js, React, Node.js). Unlike traditional single-provider chatbots, NeuraGPT uses a "Model Agnostic" backend that dynamically sends user prompts to either OpenAI or Google Gemini APIs, depending on availability and user choice. The system includes a central proxy server for zero-trust API key management, ensuring that credentials don't reach the client side. Performance tests show that this structure lowers dependency risks while keeping real-time responsiveness. By combining secure session management with a flexible, multi-

provider integration layer, NeuraGPT offers a scalable framework for the next generation of secure, enterprise-level AI applications.

Keywords: *Large Language Models (LLMs); Multi-Model Architecture; MERN Stack; API Security; Generative AI Integration.*

ICICET26SP1006T2

AI for Early Neurological Disorder Detection via Gait Analysis

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ABSTRACT
Parkinson's disease (PD) is a long-lasting and worsening neurological condition marked by motor problems like tremors, stiffness, and trouble walking. Finding the disease early is crucial for slowing its progression and improving life quality. However, traditional diagnosis often needs significant financial and clinical resources. This study presents an automated, non-invasive screening system that uses video-based gait analysis to help identify Parkinson's disease early. We process walking videos of subjects with the You Only Look Once (YOLO) algorithm for accurate human detection and to create visual overlays that improve motion understanding. We use human pose estimation techniques to capture key skeletal points and generate time-series data that reflect small movement changes. These features are then analyzed using a Convolutional Neural Network (CNN) to classify gait patterns and identify characteristics of Parkinson's compared to normal motion. The proposed system shows promise for providing an efficient, scalable, and cost-effective way to screen for PD early, especially in areas with limited specialized healthcare resources.

Keywords: *Agentic Artificial Intelligence, gait analysis, neurodegenerative disease, machine learning, deep learning, human pose estimation, gait parameters, Parkinson's disease, non-wearable sensors, ground reaction force, early detection.*

ICICET26SP1007T2

Cardiovascular Diseases (CVDS) Model

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ABSTRACT
Cardiovascular diseases (CVDs) represent the most significant threat to global health, accounting for approxi- mately 17.9 million annual deaths and placing an immense burden on international medical infrastructures. The inherent complexity of cardiac pathology, characterized by non-linear interactions between demographic, behavioral, and physiological biomarkers, renders traditional diagnostic methods—such as coronary angiography and manually interpreted electrocardio- grams (ECGs)—frequently inconsistent, costly, and subjective. This research presents a comprehensive, high-precision compu- tational framework designed to automate cardiovascular risk assessment by integrating advanced data preprocessing, meta- heuristic optimization, and state-of-the-art sequential deep learn- ing architectures.
The methodology utilizes a rigorous preprocessing pipeline that addresses the chronic issues of data sparsity and class imbalance prevalent in clinical datasets like the Cleveland Clinic, Framingham, and UCI repositories. Multivariate Imputation by Chained Equations (MICE) is implemented to preserve inter- feature correlations while resolving missing values, while K- means Synthetic Minority Over-sampling (K-means SMOTE) ensures equitable representation between healthy and diseased classes. The core of the framework evaluates the synergy between 1D Convolutional Neural Networks (1D CNN) for spatial feature extraction, Bi-directional Long Short-Term Memory (Bi-LSTM) networks for capturing

temporal health dependencies, and self- attention-based Transformers for holistic feature weighing.

Index Terms: *Heart Disease Prediction, Deep Learning, 1D CNN, Transformers, SMOTE, Particle Swarm Optimization.*

ICICET26SP1010T2

Careermate AI: An AI-Driven Real-Time Interview Assistance System Using Behavioral and Visual Cues

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ABSTRACT
Job seeking in a restructured competitive employment field is very much dependent upon how well prepared the individuals are for interviews. Conventional interview methods may not be personalized, doesnot provide instantaneous feedback or be readily available. To solve such problems, this paper introduces CareerMate AI a multimodal AI-based interview preparation system that evaluates candidates using natural language processing, computer vision, and speech analysis. It provides real-time feedback based on responses, behavior, and communication skills that help users improve interview performance effectively. The system developed uses techniques based on natural language processing, facial expression recognition and speech processing. It provides real-time feedback, AI-generated questions (both HR as well as technical) based on resume or job description and grades answers based on relevance, grammar and semantic accuracy. The system recognizes behavioral signals such as eye contact and body language, in addition to vocal characteristics including tone fluctuations, fluency and confidence. The automated scoring system offers organized and impartial assessments, while dedicated feedback reports assist users in recognizing their strengths and weaknesses. The platform is user-friendly and provides scalability for real-world interview preparation scenarios. CareerMate AI improves users' confidence, fluency, and response relevance before they enter real interviews.

Keywords: *Artificial Intelligence, Mock Interview System, Interview Chatbot, Career Preparation, Natural Language Processing.*

ICICET26SP1024T2

Realtime Classification of Heart Sound Using Heart Beat

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ABSTRACT
Over twenty-six million people are battling chronic heart failure (CHF) around the globe. The incidence of CHF has been rising by 2% per annum. Given the substantial impact of CHF and the number of sensor systems we use daily, it is surprising that there are currently very few tools available to automatically detect CHF, even from a research standpoint. In this paper, we will outline an automated method of CHF detection using heart sounds. The method utilises both traditional Machine Learning (ML) methods derived from a set of expert-defined features and Deep Learning (DL) methods based on a spectro-temporal representation of the heart sound signal. The automated CHF detection method was evaluated using recordings from 947 subjects taken from six publicly available databases as well as one database, created for this study, consisting of CHF recordings. The evaluation metric used to score the method was consistent with the evaluation method posted for a recent PhysioNet challenge. The scores for the automated CHF detection method were 89.3 (9.1 points higher than the baseline method for the challenge). The aggregated accuracy for the proposed method was 92.9% (7.1% error rate); although the experimental results are not directly comparable, the 7.1% error rate is relatively close to the percentage

of recordings labelled as “unknown” or as not being able to distinguish between heart failure, as denoted by experts, which is 9.7%. To assist researchers in developing their ML models for distinguishing between the various phases of CHF (i.e., compensatory phase after hospitalisation and the decompensated phase), we have identified fifteen expert-derived features that provide an accuracy of 93.2%.

Keywords: *Heart Failure Detection; Stress Level Detection; Heart Beat Sound; Machine Learning; Phonocardiogram.*

ICICET26SP1043T2

Signbridge: A Lightweight Framework for Real-Time American Sign Language Recognition Using Mediapipe and Mobilenetv2

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ABSTRACT
Deploying robust computer vision models for real-time American Sign Language (ASL) recognition on edge devices poses a significant machine learning challenge, primarily driven by the strict trade-off between predictive accuracy and computational latency. To address this bottleneck, we introduce SignBridge, a highly optimized deep learning framework engineered for efficient, low-latency gesture classification without relying on computationally heavy depth sensors. The proposed architecture processes standard RGB video streams, leveraging the MediaPipe framework to extract a precise spatial feature matrix consisting of 21 skeletal landmarks per hand. This compact skeletal representation is subsequently processed by a customized MobileNet V2 convolutional neural network (CNN).
To guarantee strict edge-device compatibility, the CNN architecture undergoes targeted model optimization. Through the application of layer pruning and knowledge distillation from a teacher model, the framework successfully reduces its parameter footprint by 40%—operating efficiently with just 2.1 million parameters—while fully preserving its core representational capacity.
Empirical evaluations conducted on a 27-class subset of the WLASL dataset and a custom diversified dataset yield a 96% top-1 classification accuracy for static ASL gestures. Furthermore, SignBridge achieves an inference speed of 35 frames per second (FPS) on standard consumer CPU hardware. This performance demonstrates a distinct computational advantage, outperforming VGG-16 baselines in inference speed and operating at significantly lower latency than high-compute Vision Transformers (ViT). By effectively balancing robust algorithmic accuracy with minimal resource overhead, this framework provides a scalable AI solution for integrating real-time translation into accessible mobile platforms.

Keywords: *Edge AI; Lightweight CNN; Deep Learning; Model Optimisation; Hand Pose Estimation*

ICICET26SP1050T2

Multi Agent AI Framework for Airbag Deployment Optimization

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ABSTRACT
Conventional airbag deployment strategies rely on fixed calibration rules derived primarily from vehicle crash pulse characteristics and do not explicitly adapt to variations in occupant size or seating position. This paper proposes a physics-informed, data-driven multi-agent framework that treats airbag deployment timing as a controllable parameter rather than a fixed calibration value. The method introduces phase-aware energy modeling to represent how deployment timing redistributes crash pulse energy between the vehicle structure, airbag system, and occupant. Vehicle-specific surrogate models are trained to learn injury responses as continuous functions of deployment time, while transfer learning enables scaling across different dummy sizes. Independent AI agents then optimize deployment timing for each vehicle–occupant configuration by minimizing a combined injury cost function based on head injury criterion (HIC) and chest displacement. The framework is evaluated using frontal crash test data from 18 vehicles obtained from the National Highway Traffic Safety Administration (NHTSA). Paired-case analysis shows that, under identical crash pulses and deployment timing, the 5th percentile dummy exhibits 53–66% higher head injury compared to the 50th percentile dummy, demonstrating strong anthropometry dependent energy coupling. Deployment-time optimization achieved head injury reductions of up to approximately 14% with consistent improvements in chest displacement. The results demonstrate that optimal deployment timing varies systematically with occupant size even when crash energy remains constant, providing a scalable pathway toward adaptive, occupant-aware airbag deployment strategies.

Keywords: *Automotive; Crash Safety; Agentic AI; Machine Learning;*

ICICET26SP1055T2

Exploring Rule-Based and Machine Learning Approaches for User Engagement in Social Networks

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ABSTRACT
User engagement in social networks is important for increasing user activity. Therefore, there is a need for a proper approach that uses clear rules and reliable prediction models to classify engagement accurately. To address this need, this study develops a structured framework for analyzing and classifying user engagement. The framework combines a rule-based decision-making approach with an engagement labelling mechanism and validates it using supervised machine learning techniques. This study proposes a two-part framework to analyze user activity. In the first part, a rule-based system is developed using statistical thresholds based on median values. The thresholds are used to generate activity-based recommendations. The thresholds are used to calculate an engagement score. The thresholds are used to assign a binary engagement label. The label is either high or low. The label depends on how many activity metrics exceed the threshold. In the second part, supervised machine learning models are used and it includes Logistic Regression, Random Forest, and Gradient Boosting. Model performance is measured using accuracy and other standard classification metrics.
The results show that the rule-based threshold system generates structured recommendations. It also assigns engagement labels using statistical thresholds. These rule-based labels create clear engagement categories. Supervised machine learning models are used to validate the engagement labels created by

the rule-based system. Ensemble models such as Random Forest and Gradient Boosting perform are doing better than simpler models. The novelty of this study is the combination of rule-based methods and machine learning in one framework. Engagement labels are created using statistical threshold values. After that, machine learning models are used to validate these labels.

Keywords: *Engagement labelling, Random Forest, Rule-based, supervised learning, User engagement.*

ICICET26SP1077T2

Intelligent Joint RIS Partition and Resource Optimization for Integrated Sensing and Communication Systems

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ABSTRACT
Due to the fast evolution of 6G wireless communication networks, the emergence of the Integrated Sensing and Communication (ISAC) technique becomes necessary because communication and sensing can be done simultaneously by sharing a common wireless resource. This paper presents a novel reconfigurable intelligent surface (RIS)-assisted ISAC architecture for the efficient optimization of communication embedded sensing. In the proposed system plan, the allocation of RIS elements for communication and sensing operations are dynamically optimized, as well as communication-sensing priority and power allocation, in order to make the overall performance optimal in non-stationary wireless environments. In addition, Nakagami-m fading channel models are taken to present real-time features of the communication and sensing conditions. A multi-objective reward function is developed using the sensing and communication rates and the communication-sensing tradeoff performance. Various arrangements of the RIS are analyzed to determine the best configuration of division for communications and sensing depending on different scenarios in terms of wireless channel characteristics. An extensive database of simulations is obtained via exhaustive optimization, and an intelligent predicting algorithm of learning of Random Forest is applied to predict the best RIS configuration based on the extracted communications and sensing metrics. The simulation results show that the proposed approach ensures the trade-off between communication and sensing functions with enhanced flexibility in optimizing the RIS distribution. The accuracy of predicting the best RIS dividing configuration using the Random Forest method exceeds those achieved using other conventional techniques. This framework provides a reliable and efficient solution for ISAC-RIS systems which supports wireless networks also beyond 5G and 6G.

Keywords: *ISAC; RIS; Joint Optimization; Random Forest; RIS Partitioning.*

ICICET26IS2070T2

Deep Learning-Based Object Detection for Real-Time Visual Intelligence

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ABSTRACT
Deep learning-based object detection has emerged as a fundamental technology for real-time visual intelligence, enabling machines to identify and localize objects in complex visual environments. This paper presents a deep learning approach for efficient and accurate object detection in real-time applications. The proposed system utilizes convolutional neural networks and modern object detection architectures to extract meaningful visual features and predict object classes and bounding boxes. The model is designed to achieve a balance between detection accuracy, computational efficiency, and inference speed, making it suitable for applications such as autonomous systems, intelligent surveillance,

traffic monitoring, robotics, and smart-city environments. The study evaluates the system using standard performance metrics, including precision, recall, mean Average Precision (mAP), and frames per second (FPS). Experimental results demonstrate that deep learning can provide reliable object detection while maintaining low latency for real-time processing. The findings highlight the potential of optimized deep learning models to deliver scalable and robust visual intelligence across diverse real-world scenarios.

Keywords: *Deep Learning, Object Detection, Real-Time Processing, Machine Learning, Artificial Intelligence*

ICICET26SP1108T2

AI Adoption and Formal Youth Underemployment: A Cross-Country Panel Data Analysis

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ABSTRACT

Background: The proliferation of AI is transforming the labor force around the world, but there is still an insufficient empirical understanding of the influence of AI on youth employment quality around the world. Methods: The current paper examines the impact of AI adoption on formal youth underemployment, which refers to persons aged between 15 and 24 who are working below their skill levels or involuntarily in part-time jobs, using panel regression with a fixed effects model in a dataset of 85 countries from 2000 to 2024 with floodlight analysis and K-means cluster. Results: An increase in one unit on AI adoption is linked to a decrease in underemployment among formally unemployed youth by 0.38 percentage points ($\beta_1 = -0.38, p < 0.001$, full regression; $\beta_1 = -0.35$ for Arellano-Bond GMM). Digital education has a moderating influence on this relationship ($AI \times DE$: $\beta_4 = -0.08, p < 0.001$; Johnson-Neyman critical value for $DE = 40$) and emerges as a catalyst multiplier. Conclusion: Clustering analyses identify countries belonging to low-readiness/high vulnerability (27%), moderate risk (45%), and low-risk (28%) groups. Policy simulation estimates suggest underemployment decreases of 1.2, 3.0, and 4.5 percentage points, respectively.

Keywords: *Digital Education; Labour Market Dynamics; Labour Market Mismatch; Panel Econometrics; Skill-Biased Technological Change; Technological Automation*

ICICET26SP1090T2

Airguard AI – Intelligent IoT-Based Air Quality and Environmental Monitoring System

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ABSTRACT

Air pollution has become a major environmental issue affecting human health and the ecosystem. Continuous monitoring of air quality is necessary to detect harmful gases and maintain a healthy environment. This project presents an AI-based air quality monitoring system that measures air pollution levels along with temperature and humidity in real time. The system is built using the ESP32, which acts as the main controller. The MQ135 Gas Sensor is used to detect harmful gases such as carbon dioxide

(CO_2), ammonia (NH_3), smoke, and other pollutants present in the air. The DHT11 measures environmental parameters like temperature and humidity. The collected data is processed by the ESP32 and displayed on an LCD Display. Artificial Intelligence or data analysis techniques can be applied to the collected sensor data to analyse pollution patterns and predict air quality levels. The system provides real-time monitoring and alerts when pollution levels exceed safe limits. This low-cost and efficient monitoring system can be used in homes, industries, and smart city applications to improve environmental awareness and public health. Overall, the proposed system offers a simple, reliable, and intelligent solution for monitoring and analysing air quality using modern IoT and AI technologies.

ICICET26SP1095T2

Mailshield AI – Deep Learning-Based Intelligent Email Spam Detection and Classification System

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ABSTRACT

Email spam remains a significant challenge in digital communication, posing security risks and reducing user productivity. Traditional machine-learning approaches rely heavily on manual feature extraction and often struggle to generalize in the presence of evolving spam techniques. This work presents a deep learning–based email spam classification model that automatically learns semantic and contextual features from raw email text. The proposed system employs a neural architecture—such as Long Short-Term Memory (LSTM), Convolutional Neural Networks (CNN), or Bidirectional LSTM—to extract high-level textual representations and perform binary classification between spam and legitimate (ham) messages. A pre-processing pipeline including tokenization, sequence padding, and word embeddings (e.g., Word2Vec or GloVe) is implemented to convert email content into dense vector representations. The model is trained and evaluated on a benchmark dataset, demonstrating superior accuracy, precision, recall, and F1-score compared to traditional logistic regression and Naï ve Bayes classifiers. Experimental results show that deep learning significantly enhances the detection of complex and previously unseen spam patterns. This research highlights the effectiveness of neural networks in email filtering and provides a scalable, automated solution for modern spam detection systems.

INTERNET OF THINGS, CLOUD COMPUTING & SOFTWARE SYSTEM

ICICET26IS2026T3

Bridging Cloud–Fog–IoT Continuum for Scalable, Low-Latency Intelligent Systems

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ABSTRACT
The rapid proliferation of Internet of Things (IoT) devices has transformed computing into a highly distributed and data-intensive ecosystem. While cloud computing offers scalable storage and processing capabilities, its centralized architecture often fails to meet the stringent latency requirements of real-time IoT applications. Fog computing addresses this challenge by extending cloud services closer to end devices, enabling low-latency processing and efficient resource utilization.
This talk presents an integrated Cloud–Fog–IoT framework designed to support scalable and intelligent IoT systems. The proposed architecture enables intelligent task allocation, context-aware data processing, and dynamic resource management across cloud, fog, and edge layers. Lightweight communication protocols such as MQTT and CoAP are employed to optimize data exchange in resource-constrained environments, reducing bandwidth consumption and improving system efficiency. The framework further incorporates machine learning and edge analytics within the fog layer to facilitate predictive analytics, anomaly detection, and autonomous system management. These capabilities enhance responsiveness, reliability, and decision-making in dynamic IoT environments. Security, privacy, and interoperability challenges are also discussed, highlighting the need for robust architectures capable of supporting heterogeneous devices and networks. The effectiveness of the proposed approach is demonstrated through applications in smart healthcare, smart transportation, and smart manufacturing. Results indicate significant improvements in latency, bandwidth utilization, resource efficiency, and system reliability. The proposed Cloud–Fog–IoT continuum provides a practical foundation for developing next-generation intelligent systems capable of meeting the growing demands of large-scale IoT deployments.

Keywords: *Internet of Things (IoT), Fog Computing, Cloud Computing, Edge Intelligence, Low-Latency Systems*

ICICET26SP1018T3

LinkUp: A Secure Chat and Video Communication

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ABSTRACT
Centralized architecture real-time communication systems in modern digital ecosystems have high latency patterns, lack scalability, and even expose privacy vulnerabilities. In this paper, the author describes the project LinkUp+; this is a secure and effective real-time communication platform created on the base of MERN stack and WebRTC technology. The suggested system uses peer-to-peer (P2P) communication based on WebRTC as a means to reduce the reliance on centralized servers, decreasing latency considerably and enhancing privacy of data. The largest contribution of this work is the introduction of an Adaptive Network-Aware Bitrate Optimization (ANABO) mechanism, which is activated to dynamically control the media quality in response to real-time network conditions in order

to allow seamless communication. The system uses Socket.io in order to provide effectively signaling and managing of the sessions, thus providing a reliable peer connection establishment. LinkUp+ ensures better security by combining DTLS-SRTP secure media transmission and JSON Web Token (JWT)-based user authentication and access control. Through experimental performance, it is established that the proposed system leads to the reduction of up to 50% of the latency of a traditional server-based communication models, and it preserves the quality of the audio and video transmission. The findings reveal that the LinkUp+ is a solution with a scalable, secure, and performance solution to real time communication application, which fits into the modern distributed system and the next-generation communication systems.

Keywords: *Secure video communication, WebRTC, P2P, Socket.io, MERN Stack, JSON Web Token Authentication.*

ICICET26SP1057T3

Design of a Smart Health Monitoring System for Industrial Machines Using Embedded Systems

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ABSTRACT
An Industrial Health Monitoring System has been developed for the purpose of continuous collection, processing and transmission of real-time equipment measurements. It consists of microcontrollers while they are integrated with various sensors throughout the entire process at the edge level, thus providing for more accurate monitoring of machine health.
The microcontrollers interface and facilitate communications within a closed ecosystem, via the use of different types of communication modules (Wi-Fi, Ethernet, LTE) to transfer data from the edge of the system to a centralized cloud or gateway. The resulting systems developed as a whole will be beneficial for both low-level equipment manufacturers as well as high-level management.
Low-level equipment manufacturers are able to obtain raw sensor data and subsequently utilize this information to provide detailed diagnostics, predictively maintain the equipment and optimize equipment design. High-level management stakeholders will have access to processed insights via dashboards to assist them in making decisions regarding productivity and operational efficiency. Additionally, the implementation of edge computing reduces both latency and bandwidth consumptions by performing critical processing of the data relative to the procedure locally before being transmitted.

Keyword: *Edge computing, Dashboards, Latency reduction, Sensors*

ICICET26SP1074T3

IoT Device Profiling and Security Enhancement using Transfer Learning

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ABSTRACT
The rapid growth of smart technologies and interconnected systems has led to an exponential increase in the deployment of Internet of Things (IoT) devices across domains such as healthcare, smart homes, industry, and transportation. While these devices improve automation and connectivity, their heterogeneous nature and limited security mechanisms make them highly vulnerable to cyberattacks and unauthorized access. This has intensified the need for robust security solutions against both external and insider threats. This paper proposes a novel framework combining Machine Learning (ML) and Transfer

Learning (TL) for IoT device profiling, anomaly detection, and threat mitigation. Using the CIC IoT 2022 dataset for training and the IMC 2019 Payload and IoT Sentinel datasets for testing, the approach extracts behavioral and network traffic features to classify devices with high precision and reliability. TL enables knowledge transfer across heterogeneous datasets, improving adaptability, reducing retraining effort, and enhancing generalization across diverse IoT environments. To improve interpretability and monitoring, a D3.js-powered dashboard visualizes device profiles, communication behavior, threat patterns, severity levels, and corresponding countermeasures. Experimental results demonstrate that the integration of ML and TL improves scalability, adaptability, and detection performance while maintaining strong classification accuracy. The proposed framework contributes toward intelligent and explainable IoT security systems capable of supporting proactive threat analysis and enhanced protection in modern interconnected environments.

Keywords: *Machine Learning, Transfer Learning, IoT Device Profiling, Security*

ICICET26SP1117T3

Wall Climbing and Cleaning Robot

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ABSTRACT

Maintaining the outside of high-rise buildings is a job that usually requires people to do dangerous work at great heights. This puts workers at risk of falling. Costs a lot of money. To make this work safer and less expensive a special machine was designed to clean the sides of buildings. The machine has a base that is controlled by a central computer part called an ATmega328p microcontroller. It uses an powerful motor to create a vacuum that helps it stick to the side of the building and it has four wheels that work together to help it move around. The machine can be controlled from a distance using a Bluetooth connection. When the machine was tested it was able to stick to the side of the building and move around smoothly. The cleaning part of the machine was able to sweep forth steadily and the way it was powered helped to prevent any problems with the electricity. These results show that it is possible to make a machine that can clean the sides of buildings safely and at a cost, which could help to reduce the risks faced by workers who currently do this job. The high-rise building facade maintenance is a job that needs to be done safely and at a low cost and the machine is a step, in that direction. High-rise building facade maintenance is an issue that needs to be addressed.

Keywords: *Wall-climbing robot; Vacuum suction; ATmega328p; Brushless DC (BLDC) motor; N20 gear motors; Bluetooth control; Surface cleaning automation.*

ICICET26SP1118T3

An IoT-Enabled Multi-Modal Surveillance Robot with GPS-Based Homing and Environmental Monitoring

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ABSTRACT
The growth of IoT and embedded systems has increased a lot in recent years. This is because they can do tasks in places that're hard or unsafe for humans. We present a robotic vehicle that can do many things. It can be used for surveillance, checking the environment and navigating intelligently. The novelty of the proposed system lies in integrating surveillance, environmental monitoring, GPS-based homing, obstacle avoidance, wireless control, live video streaming, and cloud-based monitoring into a single low-cost robotic platform. This makes it good for industrial inspection, monitoring environments, disaster response and smart security. The robotic vehicle uses a microcontroller ATmega328P and an ESP32 module. Together they manage the control and communication functions of the system. Users can operate the robot wirelessly using Bluetooth and voice commands. An ultrasonic sensor on a servo motor helps detect and avoid obstacles. A GPS module tracks the location and helps the robot find its way home. The system also monitors conditions using DHT11, NH_3 and H_2S sensors. The robotic vehicle sends sensor data to the ThingSpeak cloud platform using Internet. This allows monitoring from a location in real-time. A camera module provides video streaming. This enables observation of the environment. These features make the system practical for applications where remote monitoring and timely information are important. The robotic vehicle offers an affordable solution. Its design is simple and modular. This allows for improvements like artificial intelligence and autonomous navigation. The vehicle is suitable for real-world IoT-based robotic applications.

Keywords: *Internet of Things (IoT), Robotic Vehicle, Obstacle Avoidance, GPS Tracking, Environmental Monitoring.*

ICICET26SP1119T3

Modular Software Architecture for Optimizing Io Data Flows in Hybrid Cloud Environments

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ABSTRACT
Complexity of the IoT ecosystem has increased the demand for effective data processing techniques which are able to process continuously incoming heterogeneous data streams in an efficient manner

without any negative impact on predictability of the system. However, in a hybrid cloud environment, the distribution of computations between the local edge and remote cloud components usually results in the appearance of resource allocation and data exchange inconsistency that increases the latency and reduces system stability.
The current research introduces an architectural approach to optimizing IoT data flows based on the use of adaptive edge-based processing and dynamic cloud microservices orchestration. The proposed architecture splits the processing pipeline into five independent modules: data ingestion, filtering, classification, routing, and data storage. Thus, each of these modules can be adjusted individually without any changes in the architecture structure. Edge-level lightweight filtering is performed depending on the data relevance and processing priority.
Resource-aware orchestration in the cloud layer ensures that workload changes are accounted for and microservices are assigned appropriately to avoid bottlenecks when there is an increased load. This system allows for stabilization of throughput in varying traffic patterns. The results from experiments using datasets from both industrial and environmental sensors have been characterized by lower end-to-end latency and increased stability despite varying transmission patterns.
Apart from its performance, the proposed design has practical benefits that include independent updates of components, flexibility in rule inclusion, and adaptation to new Internet of Things standards.

Keywords: *IoT; Hybrid Cloud; Edge Processing; Microservices; Data Flow Optimization.*

ICICET26SP1088T3

Weather Sense – IoT-Based Real-Time Weather Monitoring and Prediction System

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ABSTRACT
An Internet of Things (IoT)-based weather monitoring system is a smart solution designed to measure, collect, and analyze environmental parameters in real time using interconnected devices. The system typically consists of sensors, a microcontroller (such as Arduino or Node MCU), and a cloud platform for data storage and visualization.
The main objective of this system is to monitor weather conditions such as temperature, humidity, atmospheric pressure, rainfall, and air quality continuously. Sensors like DHT11/DHT22 (for temperature and humidity), rain sensors are used to gather data from the environment. This data is processed by the microcontroller and transmitted over the internet using Wi-Fi or other communication technologies.
The collected data is then uploaded to cloud platforms or mobile applications, where users can access it remotely in real time. The system can also generate alerts in case of extreme weather conditions, making it useful for agriculture, disaster management, and environmental monitoring. The IoT-based weather monitoring system is cost-effective, energy efficient, and provides accurate and continuous data without human intervention. It helps in better decision-making and forecasting, thereby improving productivity and safety in various sectors.

ICICET26SP1089T3

Step2Power – IoT-Based Footstep Energy Harvesting and Power Generation System

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ABSTRACT

The IoT Based Footstep Power Generation System is an innovative and eco-friendly solution that converts mechanical energy from human footsteps into electrical energy. This system uses sensors such as piezoelectric plates installed beneath walking surfaces like floors, pavements, or stairs. When a person steps on these surfaces, mechanical pressure is generated, which is converted into electrical energy and stored in batteries for later use.

The integration of Internet of Things (IoT) technology enhances the efficiency and monitoring capability of the system. IoT devices and sensors collect real-time data on the number of footsteps, energy generated, and system performance. This data can be transmitted to a cloud platform, allowing users to monitor and analyze energy production remotely through mobile or web applications. This system is especially useful in crowded places such as railway stations, malls, and public walkways where a large number of people move daily. It promotes renewable energy usage, reduces dependency on conventional power sources, and supports sustainable development. Overall, the project demonstrates how smart technology and human activity can be combined to generate clean energy efficiently.

CYBER SECURITY & SECURE COMPUTING

ICICET26IS2017T4

Blockchain Latency in HIoT systems: A Comprehensive Review

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ABSTRACT
Internet of things ensures connectedness and has a huge contribution through its smart devices. The growth has extended itself in fabricating state of art healthcare systems as Healthcare Internet of Things (HIoT) with optimal alternatives based on prompt decision making enabling more prompt treatment. Although HIoT faces challenges such as security, privacy, latency and centralized control, it is somewhat alleviated by Fog Computing (FC) and Blockchain (BC) technology. Fog computing enables low-latency centralized data processing while blockchain guarantees security with decentralization and transparent trust. However, the operational layers like data filtering, encryption, and consensus mechanism in blockchain introduces exchange delays. HIoT devices perform data filtering that includes noise removal and redundancy elimination, but latencies in this stage critically hinder real-time health data processing which further affects decision making. Current research is focusing on optimizing HIoT system performance in terms of system-level latency by integrating consensus, queuing, and network delays with aggregated service time. However, micro-latency components, like CPU processing, memory access, hashing and verification delays, remain largely unexplored. This study represents a comprehensive review of latency reduction architectures or frameworks, emphasizing the role of the data filtering layer and encryption layer in blockchain-enabled HIoT systems.

Keywords: *Blockchain, Healthcare Internet of Things (HIoT), Latency Reduction, Data Preprocessing, Fog Computing.*

ICICET26SP1020T4

A Unified Framework for Multimedia Steganography and Steganalysis

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ABSTRACT
In the modern digital era, ensuring secure communication has become increasingly important due to rising cyber threats and data breaches. This project presents a robust text steganography system that enables secure transmission of secret information by concealing it within ordinary text. The system utilizes two innovative techniques: zero-width character encoding and synonym-based substitution.
In the zero-width character method, invisible Unicode characters are embedded within text, allowing hidden messages to remain undetectable to human readers while being accurately decoded by the system. In the synonym substitution method, selected words in the original text are replaced with their synonyms based on a predefined mapping scheme to encode secret information. This dual approach enhances both security and flexibility in data hiding.

The system supports encoding and decoding processes with key-based validation to ensure that only authorized users can retrieve the hidden message. It is designed to work with multiple types of input content, including text documents and media files, improving its practical usability.
Experimental results demonstrate that the zero-width method provides high accuracy and invisibility, while the synonym method offers readability with moderate security. The integration of both methods ensures a balance between stealth and usability. This project can be applied in secure messaging, data protection, and confidential information sharing.
Overall, the proposed system provides an efficient, secure, and user-friendly approach to text-based steganography, addressing the limitations of traditional methods.

Keywords: *Text Steganography; Zero-Width Characters; Synonym Substitution; Data Security; Information Hiding*

ICICET26SP1041T4

The Harmonic Framework: Unified Threat Modelling for AI-Driven Healthcare

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ABSTRACT
The convergence of legacy hospital information systems with artificial intelligence (AI) driven clinical decision support has expanded healthcare's cyber-attack surface faster than any single threat-modelling framework can describe. Existing audits typically apply individual frameworks such as STRIDE for technical security, LINDDUN for privacy, or MITRE ATT&CK for adversary behaviour in isolation, leaving privacy violations, clinical-impact considerations, and AI-specific threats outside the analyst's view. This paper proposes the Harmonic Framework, a unified multi-framework threat-modelling methodology that integrates five established standards STRIDE, LINDDUN, PASTA/OCTAVE, MITRE ATT&CK and MITRE ATLAS under a shared asset and trust-boundary schema. Every elicited threat is traced to controls in the United States National Institute of Standards and Technology publications SP 800-30, 800-53 and 800-207, and to regulatory obligations under the Health Insurance Portability and Accountability Act, the General Data Protection Regulation, and the European Network and Information Security Directive 2. The framework is demonstrated on a sepsis early-warning pipeline built on the publicly available Medical Information Mart for Intensive Care, version IV cohort. A preliminary catalogue of thirty-eight asset–threat pairs is elicited, of which approximately thirty-two per cent are invisible to STRIDE alone; the AI-specific subset contributes seven distinct threats including model evasion, training-data poisoning and model inversion. The integrated approach materially widens threat coverage for AI-assisted clinical workflows and provides the methodological foundation for follow-on work on differential privacy, federated learning and homomorphic encryption.

Keywords: *Healthcare AI security; threat modelling; MITRE ATLAS; sepsis early warning; HIPAA.*

SIGNAL PROCESSING & INTELLIGENT COMMUNICATION SYSTEMS

ICICET26SP1079T5

A Unified Dual-Loop Energy–Thermal–Security Co-Optimized Ultra-Low-Power RISC-V SoC with Workload-Adaptive Voltage Scaling and Runtime Anomaly Detection

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ABSTRACT
This paper presents a unified energy–thermal–security co-optimization framework for an ultra-low-power RISC-V System-on-Chip (SoC) intended for embedded and edge-computing applications. The proposed architecture integrates a workload-aware adaptive voltage scaling controller, a temperature-triggered dynamic clock-gating and frequency regulation unit, and a lightweight runtime anomaly detection block into a single dual closed-loop hardware control scheme. Workload intensity is estimated through real-time switching-activity monitoring and mapped to discrete voltage levels, while on-chip thermal conditions are continuously observed to activate frequency throttling and clock gating whenever temperature thresholds are exceeded. To further enhance robustness, the design incorporates a switching-activity-based hardware Trojan detection mechanism and a priority-optimized single-cycle interrupt controller for fast system response. The complete system is implemented in synthesizable Verilog HDL and validated on Xilinx Vivado through functional simulation, synthesis, and comparative power analysis across baseline, voltage-only, clock-only, and dual-loop configurations. Post-synthesis results indicate a compact implementation with only 29 LUTs and 44 flip-flops, demonstrating that coordinated workload, thermal, and security management can be realized with minimal hardware overhead in a small RISC-V SoC. The requirement for energy-efficient and thermally dependable System-on-Chip (SoC) designs has grown dramatically due to the quick development of edge computing, IoT nodes, and portable embedded platforms. In order to retain performance, dependability, and security, modern embedded processors must adhere to stringent power budgets. RISC-V and other open instruction set architectures have drawn a lot of interest because of their scalability, versatility, and appropriateness for specialized low-power hardware implementations.

Keywords: *RISC-V SoC, dynamic clock gating, thermal-aware architecture, Trojan detection, switching-activity monitoring.*

ICICET26SP1081T5

A Dynamic Pilot Distribution Architecture for Orthogonal Frequency Division Multiplexing Systems

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ABSTRACT
This is a study on adaptive pilot assignment algorithm in Verilog based OFDM system and then analyzed it in MATLAB. It is rare to have a fixed pilot operation without having problems with the changes of the channels, especially in noisy and/or unstable communication channels. To counter this, the proposed

scheme automatically changes the number and location of pilots based on channel behaviour during the channel adaptation process, which is cognizant of the errors. The pilot patterns are not written on in the pilot structure but rather, they are created by pseudo random binary sequence (PRBS). It is apparently crucial to ensure a good tradeoff between spectral efficiency and communication reliability, but the actual effectiveness may vary according to the actual rate of channel variations. The minimum interference and maximum stability can be achieved with the help of subcarriers and nulls as well. Results show that the design can change modes (from low to high errors and vice versa), depending on the channel conditions, by varying the density of pilots. The proposed architecture being fully-synthesizable should be suitable for FPGA implementation and potentially be a viable option for future wireless system designs like 5G and beyond. Overall, the method is a deterministic and adaptive pilot morphing which seems to increase reliability, decrease overhead and provide more accurate channel estimation.

Keywords: *Adaptive OFDM; Pilot Allocation; FPGA Implementation; Channel Estimation; Dynamic Pilot Density.*

ICICET26SP1082T5

A Cooperative Adaptive Image Processing Architecture for Real-Time Verilog-Based Hardware Systems with Confidence-Guided Context-Aware Tile

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ABSTRACT
This paper presents a novel adaptive image enhancement architecture designed for real-time hardware implementation using Verilog HDL. The proposed system employs a tile-based processing approach combined with local statistical analysis and gradient-based enhancement to dynamically adjust filtering behavior across an image. Unlike conventional fixed filters such as mean and Sobel operators, the proposed design adaptively selects smoothing, sharpening, or pass-through modes based on local intensity variations and edge information. The architecture is implemented using line buffers and a 3×3 sliding window, enabling efficient streaming-based processing suitable for FPGA deployment. Experimental validation is performed using a 19×19 grayscale image derived from the MIT CBCL dataset. The hardware output is compared with standard image processing techniques using PSNR and SSIM metrics. Results demonstrate that the proposed method achieves superior structural preservation and balanced enhancement while maintaining low hardware complexity and high throughput. Real-time image enhancement has become a fundamental requirement in modern embedded vision systems, particularly in applications such as surveillance, medical imaging, autonomous systems, and intelligent edge devices. With the increasing demand for low-latency and energy-efficient processing, hardware-based image processing architectures have gained significant attention. Among these, FPGA and ASIC implementations using Verilog HDL provide high throughput, parallelism, and deterministic performance, making them suitable for real-time image enhancement tasks.

Keywords: *Image Processing with FPGA, Adaptive Filtering, Edge Enhancement, CBCL Dataset, Real-Time Processing.*

ICICET26SP1084T5

Negative Communication for 6G: Information Transfer Using Intentional Absence of Transmission

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ABSTRACT

Negative communication is a novel and developing method of data transfer in which signals are purposefully absent rather than continuously broadcasted in order to communicate information. This approach creates a communication model that is essentially different from regular signal-based systems by using silent intervals between pulses to convey information, in contrast with traditional modulation approaches like On-Off Keying (OOK), Pulse Position Modulation (PPM), and Duty Cycle Modulation. In this study, we investigated the entire communication process—encoding, transmission, channel deterioration, and decoding—using a MATLAB-based simulation. Synthetic data was assessed under various Signal-to-Noise Ratio (SNR) levels and jitter situations to demonstrate the resilience of the suggested technique. This allowed us to examine the system's capacity to preserve data in the face of timing irregularities and noise. The results of the simulation are favourable. There is a great deal of opportunity for reducing transmission activity while maintaining dependable data recovery at the receiving end through negative communication. Because less active signalling might lead to more energy efficiency, the approach is attractive for low-power wireless devices. The results indicate that absence-based communication may become a key idea in the architecture of future 6G networks, despite the fact that practical implementation issues still exist, particularly in synchronization and hardware realization.

Keywords: *Negative Communication, On-Off Keying, 6G, MATLAB, Pulse Position Modulation*

ICICET26SP1091T8

AgroBot – IoT-Based Autonomous Farming Robot for Smart and Sustainable Agriculture

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ABSTRACT

The IoT-based farming robot is a smart agricultural system developed to improve farming efficiency through automation and modern technology. This project integrates Internet of Things (IoT) and robotic systems to monitor and manage agricultural activities effectively. The collected data is transmitted through IoT platforms, allowing farmers to monitor field conditions remotely using smartphones or computers. The farming robot can perform multiple tasks such as automatic irrigation, crop monitoring, pesticide spraying, and weed detection, reducing the need for human labor. It helps farmers make data-driven decisions for better crop management and improved productivity. The system also promotes efficient use of water, fertilizers, and pesticides, which helps in reducing resource wastage and environmental impact. By implementing smart technologies, this project supports the concept of precision agriculture and sustainable farming practices. Overall, the IoT-based farming robot provides a cost-effective, intelligent, and automated solution that can transform traditional farming into a more productive and technology-driven agricultural system.

ICICET26SP1092T5

HyperCompress AI – HASS-AE Based Intelligent Hyperspectral Image Compression System

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ABSTRACT

Hyperspectral imaging plays an important role in remote sensing because it captures detailed spectral and spatial information about Earth surfaces. However, the extremely large size of hyperspectral data creates challenges for storage, transmission, and onboard processing in practical systems. To address this issue, this work introduces AS²-AE, an adaptive spectral– spatial autoencoder designed for efficient hyperspectral image compression while retaining information relevant to spectral unmixing. Instead of compressing pre-estimated abundance maps or focusing only on reconstruction quality, the proposed framework learns compact representations directly from raw hyperspectral cubes. A spectral–spatial attention mechanism is incorporated within the encoder to highlight informative features before compression, while the latent bottleneck is structured to preserve spectral patterns associated with material signatures. This allows the model to reduce data dimensionality without significantly degrading spectral characteristics required for sub sequent analysis. The effectiveness of the method is evaluated on several benchmark hyperspectral datasets. Experimental results demonstrate that the proposed approach achieves substantially higher compression ratios than conventional and recent learning based techniques while maintaining competitive reconstruction accuracy and low spectral distortion. These findings suggest that AS²-AE provides a practical and scalable solution for hyperspectral data compression in scientific analysis as well as resource-constrained remote sensing platforms.

Index Terms: *HSI compression, spectral spatial autoencoder, unmixing, abundance representation, reconstruction error, CR, mean spectral angle distance.*

ICICET26SP1093T8

SmartRide – LQR-Based Active Suspension and Intelligent Vehicle Stability Control System

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ABSTRACT

Vehicle ride comfort and road handling are major concerns in modern transportation systems. Traditional passive suspension systems are limited in their ability to adapt to varying road conditions. This project would present the modelling, simulation, and control of an Active Suspension System using an LQR (Linear Quadratic Regulator) controller. A quarter-car model will be used to represent the vehicle dynamics. The control objective is to minimize vehicle body vibrations while maintaining tyreroad contact. MATLAB/Simulink would be used for system modelling and controller design. Simulation results show that the active suspension system significantly improves ride comfort compared to passive suspension. Although suspension is a mechanical system, the control, sensing, and
actuation are completely electronics. This project demonstrates the application of control systems, signal processing, and embedded concepts, making it highly relevant to Electronics and Communication Engineering.

ANTENNAS, RF, VLSI & EMBEDDED SYSTEMS

ICICET26IS2021T6

A Compact and Flexible Textile Antenna with Reduced SAR for Wearable Application

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ABSTRACT
The rapid growth of wearable electronics has increased the demand for flexible and safe communication devices that can be seamlessly integrated with clothing. This study presents the design, fabrication, and integration of a wearable textile antenna developed on a flexible fabric substrate for body-centric wireless communication applications. The proposed antenna combines compact dimensions, mechanical flexibility, and reliable electromagnetic performance, making it suitable for continuous wearable use.
A novel antenna geometry is employed to achieve efficient operation while maintaining user comfort. Careful selection of textile materials and consideration of their electromagnetic properties contribute to stable antenna performance under practical wearable conditions. The integration approach enables the antenna to conform to the human body without significantly affecting its functionality.
A major focus of this work is the reduction of Specific Absorption Rate (SAR), ensuring minimal electromagnetic energy absorption by human tissues. Through optimization of the antenna structure and material composition, SAR levels are effectively reduced, enhancing user safety. The antenna also incorporates a protective configuration that limits direct radiation exposure to the body.
Simulation and experimental results demonstrate satisfactory impedance matching and stable radiation characteristics under bending conditions. The close agreement between measured and simulated outcomes validates the design methodology. The proposed textile antenna offers a promising solution for wireless body area networks, healthcare monitoring, and next-generation wearable communication systems.

Keywords: *Specific Absorption Rate; flexible fabric; wearable devices; material integration; electromagnetic safety*

ICICET26IS2023T6

Antenna Design using Machine Learning Techniques

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ABSTRACT
This paper will present the application of machine learning techniques for designing antennas. Standard analytical equations provide initial dimensions for antenna designing but require optimising of parameters before actual fabrication of antenna element. It is a time-consuming process as it requires repeated computationally heavy electromagnetic simulations of the structure, also non-standard antenna geometries could not be designed using such conventional techniques. The alternative is to use machine learning(ML) algorithms such as supervised, unsupervised and reinforcement learning which is a subset of artificial intelligence in the designing. The ML algorithms had been used to predict frequency, gain ,bandwidth, inverse modelling of antenna and beamforming etc. A comprehensive review of ML based Antenna designs and their future scope will be highlighted in this paper.
Keywords: *Antennas; Machine learning; Artificial Intelligence.*

ICICET26IS2029T6

Plasma – RF Field Coupling in GaN IMPATT diode

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ABSTRACT
IMPATT (Impact Ionization Avalanche Transit-Time) diodes are high-frequency sources that exhibit negative resistance through avalanche multiplication and carrier transit-time delay. At high RF fields, an intense carrier concentration called plasma is created in the avalanche region, leading to strong interaction with the applied radio-frequency (RF) field that is crucial for enhancing device efficiency and operational stability and optimizing the RF output power. This study explores the dynamics of plasma formation and its interaction with RF fields within the diode by employing a self-consistent framework based on carrier continuity, Poisson's equation, and energy transport models. Selection of proper device material with wide bandgap like GaN can lead to very high frequency generation with maximum RF efficiency and power while minimizing the inherent avalanche noise in the device. Use of double drift structure (DDS) in the device can even enhance the radio frequency power. The results show that key parameters such as doping concentration, depletion layer thickness, and bias conditions play a crucial role in controlling plasma behaviour and optimizing device output. Energy exchange between the RF field and plasma concentration leads to oscillations in current and field. These insights are particularly valuable for advancing IMPATT diode applications in high-frequency and terahertz systems.

Keywords: *Plasma, heterojunction, double drift structure, avalanche noise.*

ICICET26SP1001T6

Simulation of a 2.4 GHz Wi-Fi Microstrip Circular Patch Antenna for Radio Frequency Energy Harvesting in Low Power Applications

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ABSTRACT
With the rapid growth of wireless network and IoT technology, there is an increasing demand for innovative solutions that can power low-energy electronic devices without relying solely on conventional batteries. A compact microstrip antenna is presented and simulated using CST Microwave Studio for low power applications. The proposed circular patch antenna, designed at 1.6 mm thick with a circular patch of Rogers RT5880 substrate, operates at about 2.4 GHz (Wi-Fi) ISM Band. The antennas are designed using inset-fed techniques to achieve proper impedance matching with a 50 Ω feed line. Simulation results demonstrate good impedance matching with S_{11} values below −20 dB at the target frequency, indicating minimal reflection losses. The circular patch antenna exhibits accurate resonance at 2.4 GHz with a compact structure and simpler matching.

Keywords: *RF energy harvesting (RFEH); microstrip patch antenna; Wi-Fi energy harvesting; circular patch; CST simulation; low power applications.*

ICICET26SP1026T6

Analysis and Implementation of Different Op-Amp Topologies

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ABSTRACT

Operational amplifiers are widely used in analog circuits. They mainly support signal amplification, filtering, and conditioning. They also play an important role in communication, instrumentation, and control systems. This paper presents the design and comparison of three CMOS op-amp types, including single-stage, folded cascode, and two-stage designs. The circuits use 90 nm CMOS technology, and the simulation uses the Cadence Virtuoso tool. The analysis uses AC and transient methods to study performance. Important parameters include gain, gain bandwidth product, phase margin, power consumption, and stability. The results show that the single-stage op-amp consumes less power, while the folded cascode op-amp provides good gain and bandwidth. The two-stage op-amp achieves higher gain, but it also increases complexity. This study helps in selecting a suitable op-amp for different analog applications.

Keywords: *Operational Amplifier, Single-Stage Op-Amp, Folded Cascode Op-Amp, Two-Stage Op-Amp, CMOS Technology.*

ICICET26SP1045T6

Hexagonal Split Ring Resonator Enabled Low-Profile Circularly Polarized Stacked Microstrip Antenna for Short-Range Vehicular Communication Application

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ABSTRACT

The rapid expansion of wireless technologies has intensified the demand for compact, high-performance antennas in vehicular communication systems, particularly for dedicated short-range communication (DSRC) applications. In this work, a novel metamaterial-assisted low-profile stacked rectangular microstrip antenna is proposed to address the challenges of miniaturization, gain enhancement, and directional radiation. The antenna features a compact footprint of 19 × 30.2 × 3.2 mm3, and operates at a resonant frequency of 5.8 GHz, covering the DSRC band (5.8–5.9 GHz) with adequate impedance bandwidth. A key contribution of this design is the integration of a complementary hexagonal split ring resonator (CHSRR) employed as a metamaterial superstrate above the stacked configuration. This approach significantly improves gain and directivity without increasing the antenna size, offering a practical solution for space-constrained vehicular platforms. The antenna is realized using cost-effective Neltec (NH9230) substrates, ensuring ease of fabrication and scalability.

The proposed design is validated through simulation and experimental measurements, demonstrating strong agreement between simulated and measured results. Furthermore, a comprehensive parametric study is conducted to optimize antenna performance. The proposed antenna thus presents an efficient and

compact solution for next-generation vehicular communication systems.

Keywords: *Metamaterial structure, Beam forming, Complementary Hexagonal Split Ring Resonator, vehicular communication system.*

ICICET26SP1072T6

Design and Optimization of a Low-Power High-Performance CMOS Operational Amplifier for Analog VLSI Systems

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ABSTRACT

The increasing integration density of nanoscale CMOS technologies has created significant challenges in the development of high-gain and energy-efficient analog circuits for modern VLSI applications. Operational amplifiers are essential components in analog and mixed-signal systems used in biomedical instrumentation, communication devices, and signal processing circuits. However, deep submicron CMOS technologies suffer from reduced intrinsic gain, low output resistance, leakage current, and stability degradation, which limit the performance of conventional amplifier architectures. In this work, a high-gain and low-power CMOS operational amplifier is designed and analyzed using 90 nm CMOS technology. The proposed amplifier employs optimized transistor sizing, current mirror biasing, and gain enhancement techniques to achieve improved voltage gain, enhanced bandwidth, and stable operation while maintaining low power dissipation and compact circuit architecture. The complete circuit design and simulation were carried out using Cadence Virtuoso environment. Extensive circuit-level simulations were performed to evaluate important performance parameters, including open-loop gain, phase margin, bandwidth, and power consumption. The simulation results demonstrate that the proposed amplifier achieves a high open-loop gain of 63.65 dB with a phase margin of 74.083°, indicating stable and reliable operation. In addition, the amplifier exhibits a bandwidth of 25.647 MHz and consumes only 272.766 μW of power, making it suitable for low-power and high-speed analog applications. Compared with conventional CMOS operational amplifier designs, the proposed architecture provides improved gain, enhanced stability, and better frequency response without increasing circuit complexity, making it suitable for modern analog VLSI and mixed-signal integrated circuit applications.

Keywords: *CMOS op-amp; Analog VLSI; Low-power amplifier; High gain; 90 nm CMOS.*

ICICET26SP1123T6

Metamaterial Inspired Multiband Patch Antennas for Wireless Applications: A Comprehensive Technical Review

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ABSTRACT
A growing need for miniaturized multiband antennas with enhanced performance is driving research in the domain of compact antennas for a wide range of wireless communication standards from WLAN, WiMAX, sub-6 GHz 5G/6G, UWB, IoT, biomedical telemetry, and wearable electronics. Microstrip patch antennas (MPA) suffer from a high Q-factor and, therefore, have a narrow fractional bandwidth (<5%) and operate mostly at a single resonant frequency. This can be overcome by utilizing metamaterials (MTM) that possess subwavelength resonant elements including Split Ring Resonators (SRR), Complementary SRR (CSRR), Electromagnetic Band-Gap (EBG) structures, and Composite Right/Left-Handed (CRLH) transmission line (TL) elements that cause a negative refractive index, slow wave effect, Zeroth-Order Resonance (ZOR), and additional LC resonances by engineering the permittivity and permeability of the materials. This article reviews recent advances in MTM-inspired multi-band antennas with a focus on the period 2018-2026. The operating principles of the reported designs, based on the equivalent circuit models of MTM elements, are discussed. Particular attention is paid to the design methods reported for multi-band and wide-band patch antennas including MTM-inspired slot structures, SRR/CSRR, and various CRLH-TL circuits, EBG, and reconfigurable/flexible antennas. The review analyzes the performance of the described designs in terms of applications, miniaturization, bandwidth enhancement, gain, efficiency, and SAR. Various recent works that employ CRLH-TL structures are discussed and compared in terms of size, bandwidth, frequency-scanning capabilities, and applications, including CP antennas, frequency-scanning (leaky-wave) arrays, and flexible/wearable designs. The review highlights the challenges and opportunities in designing MTM-based antennas, including the use of machine learning techniques for inverse design problems and THz MTM antennas.

Keywords: *Metamaterial; multiband patch antenna; CRLH; SRR/CSRR; wireless communications*

ELECTRICAL SYSTEMS, POWER & ENERGY INFORMATICS

ICICET26IS2060T7

Some Aspects of Mathematical Modelling of Inverter-Fed Three Phase Normal Induction Motor and Three Phase Doubly Fed Induction Motor Based on Harmonic Analysis and Two-Port Network Analysis, Respectively

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ABSTRACT
This paper basically looks into some typical mathematical modelling aspects of three phase induction motors as a two-fold problem: (a) Firstly, a singly-fed normal induction motor excited from a power-electronic inverter can be modelled using equivalent circuit approach, and (b) Secondly, using an established model of a three phase doubly-fed induction motor based on two-port network, a family of receiving-end power circle diagrams can be developed.
The first problem can be looked upon as the harmonic modelling of a major electrical a.c drive component which is generally, in most of the applications, a three-phase induction motor. The square-wave output voltage waveform of a voltage source inverter can be analysed using "Fourier Series Analysis". Corresponding to each harmonic component of the obtained Fourier series, several equivalent circuits can be developed and based on each equivalent circuit, the performance figures of the said motor like input current, input power factor, efficiency, electromagnetic torque etc., may be computed. As an overall estimate, the design and computation work based on such harmonic analysis, may show better accuracy and consequently, may open up a new horizon in the field of mathematical modelling of electrical drives.
The second problem deals with a doubly-fed three phase induction motor which is fed from two sources of electrical power, leading to have an equivalent circuit in the form of a two-port network and the ABCD-parameters can be computed under dynamic condition of the motor as functions of a very important machine parameter which is known as slip. This modelling is an established research work and based on such model, a family of receiving-end power circle diagrams can be developed or, constructed for each value of slip. Therefore, the equivalent circuit of a doubly-fed induction motor can be clubbed with that of a transmission line. Thus, this particular modelling may open another horizon in the research field of modelling of power system interaction with induction motor load.

ICICET26IS2063T7

Physics-Informed Deep Reinforcement Learning for Intelligent Power Management and Voltage Stability in Renewable-Dense Smart Grids

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ABSTRACT

The rapid integration of volatile renewable energy sources (RES) and electric vehicle (EV) charging infrastructures poses unprecedented challenges to the operational stability and power management of modern smart grids. Traditional centralized control algorithms often struggle to compute optimal power flows in real-time under high uncertainty. To address this, this paper proposes a novel Physics-Informed Deep Reinforcement Learning (PI-DRL) framework for real-time, intelligent power management and voltage regulation in microgrids. Unlike purely data-driven approaches that can violate physical grid constraints, our framework embeds the non-linear power flow equations directly into the reward function and neural network architecture of a Multi-Agent Deep Deterministic Policy Gradient (MADDPG) algorithm. This ensures that the AI's operational decisions respect the thermal limits of transmission lines and voltage boundaries. We evaluate our proposed approach using standard IEEE bus test systems modified with high penetration levels of wind, solar, and dynamic EV loads. Experimental results demonstrate that the PI-DRL framework outperforms conventional heuristic and standard reinforcement learning algorithms, reducing energy losses by up to 14% and eliminating voltage violation risks, while achieving sub-second computational inference times. This work offers a scalable, safe, and energy-efficient solution for autonomous decision-making in next-generation electrical systems.

Keywords: *Physics-Informed; Deep Reinforcement Learning; Smart Grids; Real-time.*

ICICET26SP1109T7

Energy-Aware Design and Mission Planning of Solar-Assisted Fixed-Wing UAVs under Saharan Irradiance and Wind Conditions

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ABSTRACT

Solar-assisted unmanned aerial vehicles (UAVs) are promising platforms for long-endurance civil missions in remote and high-irradiance regions. Nevertheless, their practical endurance is governed by a coupled balance between local irradiance, photovoltaic conversion efficiency, battery state of charge, wind-induced propulsion penalty, payload demand, and flight scheduling. This paper presents a reproducible MATLAB-based energy-aware sizing and mission-planning framework for small fixed-wing solar-assisted UAVs operating in Algerian Saharan and Mediterranean environments. Five representative sites are examined: Algiers, Ghardaïa, Ouargla, Béchar, and Tamanrasset. The proposed Mission Feasibility Index quantifies the available energy margin during a six-hour daytime mission. The numerical results show that all selected sites are feasible under the adopted reference UAV parameters, with Mission Feasibility Index values ranging from 0.19 in Algiers to 0.32 in Tamanrasset. Daily photovoltaic energy ranges from 711 Wh to 887 Wh for a 0.90 m2 photovoltaic area, while the minimum battery state of charge remains above the 20% safety reserve. A sensitivity analysis further shows that solar UAV feasibility depends strongly on photovoltaic area and cruise propulsion power. The results demonstrate that solar integration is an effective endurance extender for daytime missions, while persistent 24-hour operation would require larger photovoltaic area, lower cruise power, higher battery capacity, or a larger high-aspect-ratio configuration.

Keywords: *Solar-powered UAV; energy-aware mission planning; long-endurance UAV; photovoltaic integration; battery state of charge.*

ICICET26SP1111T7

Adaptive MPPT and Battery-Aware Power Management for Lightweight Solar-Powered UAVs

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ABSTRACT

Lightweight solar-powered unmanned aerial vehicles (UAVs) require highly efficient onboard power management because the available photovoltaic surface is limited and environmental conditions vary rapidly during flight. Conventional maximum power point tracking (MPPT) algorithms, such as fixed-step Perturb and Observe (P&O), are attractive because of their simplicity but may suffer from steady-state oscillation and slow response during irradiance transients, aircraft attitude changes, and partial shading. This paper proposes and evaluates an adaptive fuzzy MPPT and battery-aware energy management strategy for a lightweight fixed-wing solar UAV. The proposed controller adapts the perturbation step according to the local power-voltage slope, irradiance variation, battery state of charge (SOC), and charge-current limits. A reference eight-hour mission profile is simulated, including two

cloud-induced irradiance drops and a six-hour cruise window. The adaptive fuzzy MPPT is compared with fixed-step P&O and Incremental Conductance (IncCond). Numerical results show that the proposed strategy increases harvested photovoltaic energy from 632.8 Wh to 658.7 Wh compared with fixed-step P&O, corresponding to a 4.1 % gain. It also improves average MPPT efficiency from 94.62 % to 98.50 %, raises the final battery SOC from 78.3 % to 82.6 %, and reduces tracking time after irradiance transients. Sensitivity analysis confirms that the proposed method is most beneficial when photovoltaic area is constrained and cruise power is close to the solar generation limit. The proposed approach is suitable for low-power embedded implementation in solar assisted UAVs used for monitoring, inspection, and precision agriculture.

Keywords: *adaptive MPPT; Solar UAV; fuzzy logic control; photovoltaic energy harvesting; energy-aware flight.*

ICICET26SP1116T7

Power Transformer Health Indexing via Sweep Frequency Response Analysis and Modified Spectral Wasserstein Distance

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ABSTRACT
Power transformers are critical assets in electrical grids, requiring highly sensitive diagnostic techniques for early-stage fault detection. Sweep Frequency Response Analysis (SFRA) is widely adopted for identifying mechanical deformations in transformer windings. However, the internationally standard Correlation Coefficient (CC) method suffers from severe mathematical saturation and a critical "blind spot" when evaluating shape-preserving or phase-coherent spectral shifts, often resulting in dangerous false-healthy classifications. To overcome this limitation, this paper introduces a novel diagnostic framework based on the Modified Spectral Wasserstein Distance Index (MSWDI), leveraging Optimal Transport theory to integrate physical frequency-axis displacement work. The proposed method was rigorously validated using a targeted benchmark dataset of 58 critical transformer fault signatures specifically isolating worst-case scenarios where the traditional CC exhibits misleadingly high similarity metrics (CC $\geq$ 0.98). The empirical results demonstrate that in cases where the standard CC fails catastrophically yielding a deceptive score of 0.999634 the proposed MSWDI successfully isolates the latent defect by registering an unambiguous value of 7,452.34. Furthermore, the MSWDI demonstrates an explosive dynamic range, scaling up to 149,402.05 in severe localized anomalies, thereby effectively neutralizing mathematical saturation. The findings confirm that the proposed MSWDI offers exceptional sensitivity and resolution, establishing a reliable mathematical framework for early-stage power transformer fault indexing and predictive maintenance.

Keywords: Power Transformers, Sweep Frequency Response Analysis (SFRA), Fault Diagnosis, Wasserstein Distance, Optimal Transport, Correlation Coefficient.

ICICET26SP1121T23

Smart Battery Swapping and Energy Management in Urban Electric Vehicles

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ABSTRACT
The increasing adoption of urban two-wheeled electric vehicles (EVs) demands efficient energy management solutions to minimize charging time, optimize battery utilization, and enhance vehicle availability. Battery swapping has emerged as a promising alternative to conventional plug-in charging by enabling the rapid replacement of discharged batteries with fully charged ones, thereby significantly reducing vehicle downtime. This paper presents an Internet of Things (IoT)-enabled smart battery swapping and energy management framework for urban EV applications. The proposed system integrates an advanced Battery Management System (BMS) with real-time State-of-Charge (SOC) and State-of-Health (SOH) monitoring, battery temperature and voltage sensing, charging station coordination, and intelligent battery allocation to ensure safe and efficient battery utilization. An IoT-based communication network enables seamless data exchange among electric vehicles, battery swapping stations, cloud servers, and mobile applications, supporting real-time battery tracking, remote monitoring, online battery reservation, station availability updates, predictive maintenance, and secure user authentication. The energy management controller optimizes battery charging and distribution based on battery condition, station capacity, grid status, and vehicle demand while preventing overcharging, excessive discharge, and thermal stress. The proposed framework is evaluated through simulation using key performance indicators such as energy consumption, battery utilization, swapping time, station throughput, communication efficiency, battery availability, and operational performance. Simulation results demonstrate that the IoT-enabled battery swapping strategy significantly reduces vehicle downtime, improves battery lifespan, enhances charging infrastructure utilization, and increases overall system efficiency. The proposed framework provides a reliable, scalable, and sustainable solution for next-generation intelligent battery swapping networks, supporting smart city transportation through integrated IoT, cloud-based monitoring, and intelligent energy management.

Keywords: *Electric Vehicles1; Battery Swapping2; Internet of Things3; Battery Management System4; Sustainable Transportation5.*

ICICET26SP1044T7

Design and Implementation of an ESP32-Based Synchronous MPPT Solar Charge Controller with Incremental Conductance Algorithm

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ABSTRACT
This paper presents the comprehensive design, implementation, and performance analysis of an 800W Maximum Power Point Tracking (MPPT) solar charge controller specifically engineered for Indian rural electrification applications. The proposed system utilizes synchronous buck topology with IRF3205 MOSFETs (Infineon Technologies AG, Neubiberg, Germany) (RDS (on) ≈ 8.0mΩ, VDS,max = 55V) and ESP32 microcontroller (Espressif Systems, Shanghai, China)-based control with Incremental Conductance (INC) algorithm. Unlike conventional Perturb and Observe methods, the INC algorithm provides superior tracking under rapidly varying irradiance conditions typical of Indian monsoon seasons. The design employs low-cost shunt based current sensing with the ESP32's internal 12-bit analog to

digital converter (ADC) enhanced through polynomial calibration and 64x oversampling, eliminating expensive Hall-effect sensors. Hardware-enforced dead-time protection via IR2104 gate drivers (Infineon Technologies AG, Neubiberg, Germany) prevents shoot through conditions. Experimental validation demonstrates conversion efficiencies of (94–96) %, with conduction losses reduced from 15.68 watt (asynchronous) to 6.27 watt (synchronous) at 800W output. The system accepts input voltages from 18V to 50V and delivers up to 30A output current, suitable for 12V/24V battery systems prevalent in Indian off-grid installations.

Keywords: *Maximum power point tracking, Buck converter, Battery Management, Renewable Energy Integration, Home Energy Management Systems.*

ICICET26SP1047T7

Design and Simulation of a Solar PV System with Grid Backup for Residential Applications Using MATLAB Simulink

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ABSTRACT
This paper presents the design and simulation of a solar photovoltaic (PV) system with grid backup for reliable domestic power supply using MATLAB Simulink. The proposed system utilizes a PV array as the primary energy source, delivering an initial DC output of approximately 150 V. A DC–DC boost converter is employed to step up the voltage to 220 V, which is then converted into AC using a DC–AC inverter to supply residential loads.
The system operates in a solar-priority mode, where the PV source supplies power to the load under sufficient irradiance conditions. During periods of low solar generation or absence of sunlight, the utility grid acts as a backup source to ensure uninterrupted power supply. A control mechanism is implemented to manage source switching between the PV system and the grid, preventing simultaneous connection and ensuring safe operation. A variable resistive load is incorporated to analyse system performance under varying irradiance levels. Simulation results demonstrate stable voltage output, effective source transition, and improved utilization of solar energy without the need for battery storage. The proposed system offers a cost-effective and low-maintenance solution for residential applications, highlighting its potential for sustainable energy adoption in regions with intermittent solar availability.

Keywords: Solar Photovoltaic (PV) system; DC-AC converter; MATLAB/Simulink; Simulation

ICICET26SP1059T7

PV Based Ultra-Fast Battery Charging Station of Small EVs for Sustainable Solution in Rural India

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ABSTRACT
Nowadays small Electric Vehicles (EVs) are mostly used in rural and urban areas for passengers and goods transportations. EVs are also called next generation vehicles because, there are lots of advantages of EVs but the main disadvantages is its too long charging time as well as charging efficiency. To overcome the issues this work proposed an adaptive multi-layer power management system, which is designed to achieve ultra-fast EV charging techniques, where proposed prototype system maintain the

grid stability and ensure charging efficiency. The proposed system designed with Dynamic power allocation, where the power distribution can change continuously depending on the number of EVs, without overloading the system.
The power circuit of the proposed work developed by using a Maximum Power Point Tracking (MPPT) charge controller to control and manage the optimised EV charging, the operation of the charge controller based on P&O algorithm. The power converter transforms grid AC power to regulated DC power to fit EV batteries to achieve efficient and stable charging. The vehicle interface creates the physical and communication interface between the EV and the charging station, providing a safe power transfer and data exchange. The battery State of Charge (SOC) and charging also taken into account.
The Vehicle-to-Grid (V2G) system is another advanced feature of this project that allows the power flow in both directions. It implies that EVs not only can consume power, they can also supply power back to the grid during peak demand, enhancing grid stability and efficiency. In general, this multi-layer architecture, combines monitoring, intelligent control, energy management, and charging infrastructure into one system, which provides fast, efficient, and reliable EV charging and maintains grid stability.
Furthermore, the integration of solar energy used as a distributed power generation system, enhance the system efficiency. The surplus energy is stored in batteries and utilized at high demand or when electricity generation is less which decreases reliance on the grid and enhances sustainability.

Keywords: *Electric Vehicles; State of Charge; Vehicle-to-Grid; Ultra-fast EV charging;*

ICICET26SP1063T7

Real Time Optimization of Power Flow in a Smart Community Microgrid Integrating Battery Swapping and Renewable Sources

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ABSTRACT
This paper represents a MATLAB based simulation designed to make electric vehicle (EV) charging more cost effective and efficient within smart microgrids. The framework combines solar power, battery storage, swapping stations and main grid interactions. By integrating AI and MATLAB's optimization tools, the model creates economical EV charging schedules that maintain grid stability amid fluctuating demand and variable electricity prices. It also features real time battery inventory tracking and dynamic load balancing across stations. Ultimately, the simulations demonstrate that combining AI driven control with renewable energy significantly boosts the operational and economic efficiency of modern power grids.

Keywords: *Microgrid; Battery Swapping; Renewable Energy; Energy Management*

ICICET26SP1083T7

Fault Identification in UPFC compensated transmission line Using Supervised Machine Learning

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ABSTRACT
The modern power systems with various compensating devices and smart grids need advanced fault-identification techniques for quick removal of fault and restore power supply efficiently to maintain reliability of the system. This research uses machine learning classifiers to identify six fault types in

Unified Power Flow Controller (UPFC) - compensated transmission line. A dataset is constructed with maximum normalization values of wavelet detailed coefficients of three phases and ground currents decomposed with Daubechies wavelet. These values are taken at various locations of the transmission line by varying the fault resistance for six fault cases: ABC, BC-G, BC, AG, B-G, and C-G. This research applies multiple machine-learning techniques like Ensemble, SVM, KNN, J48, Decision Tree, and Random Forest on the dataset. Furthermore, the experiment conducts an exhaustive study to identify the best-performing classifiers for fault diagnosis, while employing numerous performance metrics to comprehensively study the effectiveness of the machine learning classifiers used in this research. Specifically, the J48, Decision Tree, and Random Forest algorithms demonstrated exceptional performance, achieving an average fault classification accuracy of over 99%.

Keywords: *UPFC; Discrete Wavelet Transform (DWT); Machine Learning Classifiers; Fault Identification.*

ICICET26SP1103T7

IoT-Based Prepaid Smart Energy Meter with Integrated Power Factor Measurement System

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ABSTRACT
The traditional post-paid energy metering system in India suffers from significant challenges including, inaccurate billing, energy theft, delayed payment processing, and manual meter reading overhead. Aggregate technical and commercial (AT&C) losses in Indian power distribution utilities remain a persistent concern. This paper presents the design, implementation, and performance evaluation of an Internet of Things (IoT)-based prepaid energy meter system for Indian residential and small commercial consumers, addressing these limitations through real-time monitoring, prepaid balance deduction, and automatic load disconnection. The system uses an ESP32 microcontroller interfaced with a PZEM-004T energy monitoring module for measurement of voltage, current, active power, frequency, energy consumption, and power factor. The architecture includes an edge meter unit, cloud infrastructure using Google Firebase, and a Progressive Web Application supporting remote recharge workflows aligned with India-centric payment habits (e.g., UPI). Experimental results demonstrate measurement accuracy within ±1% for voltage and ±2% for current, with a power factor calculation accuracy of ±0.01, meeting the practical requirements of low-voltage metering. The prototype achieves automatic load disconnection within 500ms of balance depletion and maintains cloud synchronization with average latency below 2s under stable Wi-Fi conditions. The implementation is cost-effective at approximately INR 4,500 per unit, significantly lower than typical commercial smart prepaid meters (often INR 15,000–20,000), enabling affordable deployment.

Keywords: *IoT, Smart Metering, Power Factor, Cloud Computing, Energy Management.*

ICICET26SP1106T7

DISCOM Strategies for EV Charging Integration in Indian Distribution Grids Amid Rising PV Penetration: A Literature Review

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ABSTRACT
India's electricity distribution networks are being reshaped by the rapid, simultaneous growth of rooftop photovoltaic (PV) generation and electric vehicle (EV) charging load, exposing operational and planning gaps that conventional radial-feeder design did not anticipate. This review synthesises approximately 100 studies — predominantly post-2018 — to map the technical, operational, and regulatory landscape governing EV–PV integration in Indian distribution grids, with particular reference to DISCOMs. The Indian context differs materially from Western settings: two-wheeler and three-wheeler EVs dominate the fleet, single-phase domestic charging prevails, LT feeders exhibit high R/X ratios (1.5–3.0), three-phase imbalance is endemic, and AMI coverage remains partial. Documented field-level impacts include the "double-violation" voltage pattern, harmonic distortion frequently exceeding IEEE 519 limits, evening peak amplification of 25–50 percent, accelerated transformer thermal ageing, and protection mis-coordination under reverse power flow. Mitigation pathways examined include time-of-use tariffs, smart-charging architectures (OCPP 2.0.1, OpenADR 2.0b), MILP and reinforcement-learning scheduling, probabilistic EV–PV forecasting, and Vehicle-to-Grid (V2G) services. The review identifies five gaps where existing literature does not yet serve Indian DISCOM realities: the absence of an Indian benchmark feeder model, DISCOM-centric scheduling formulations with CERC compliance embedded as constraints, Indian-calibrated joint EV–PV probabilistic forecasting, robust scheduling under partial AMI observability, and an India-specific V2G regulatory and commercial framework. Addressing these gaps is essential for translating global research into deployable DISCOM strategies under Indian operational and regulatory conditions.

Keywords: *Electric vehicle integration; Rooftop photovoltaic; Distribution network impact; DISCOM operations; Smart charging.*

CONTROL SYSTEMS, ROBOTICS AND AUTOMATION

ICICET26SP1021T8

Wireless RFID, Fingerprint with ESP Cam Security Access Control Along with User Database Management

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ABSTRACT

The combination of RFID (Radio Frequency Identification) technology with microcontroller platforms such as the ESP32 has made it possible to create sophisticated, automated Automatic People Counters. The aim of this paper was to discuss a wireless smart access control system that utilizes RFID, fingerprint authentication, and ESP32-CAM video surveillance along with user database management to improve security in residential and institutional settings. This system incorporates RFID for instant identification of users, a fingerprint sensor (RS-307) for precise biometric validation, and the ESP32-CAM for real-time image capture and device monitoring over Blynk and other platforms, also for storing media. A hardware solution based on Arduino UNO with software from Arduino IDE, the system supported multi-

factor authentication with endorsed logging in the central storage device via a database. In this paper, the comparative analysis with existing solutions of the previous studies along with response time (<2 seconds) and integration scope have also been discussed. From the findings based on our experiment, it is stated that there was a 100% successful try with RFID access control and a 98% successful try with fingerprint biometric access control (RS-307), and the ESP32-CAM was partially able to perform features due to hardware implementation challenges.

Keywords: *Wireless, Smart Access, RFID, Fingerprint Authentication, ESP32-CAM, Hardware, Software, Real-Time Etc.*

ICICET26SP1107T8

Control of Agricultural Appliances of Solarised Farms

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ABSTRACT

The rapid growth of the global population and the increasing demand for sustainable food production has necessitated the adoption of intelligent, energy-efficient, and environmentally sustainable agricultural technologies. Conventional farming practices frequently encounter challenges such as inefficient resource utilization, dependence on unreliable power supplies, excessive water consumption, high operational costs, and limited real-time monitoring capabilities, particularly in rural and remote regions. To address these issues, this paper presents a smart agricultural automation system entitled “Control of Agricultural Appliances of Solarised Farms,” which integrates renewable energy and embedded control technologies to enable autonomous farm management. The proposed system is centered on an Arduino Uno microcontroller interfaced with multiple sensors, including soil moisture, temperature, light intensity (LDR), and ultrasonic water-level sensors, to continuously monitor field conditions and automate agricultural operations. Powered by a solar photovoltaic system with battery backup, the solution ensures uninterrupted operation independent of conventional grid infrastructure. Based on real-time sensor data, the system automatically controls irrigation pumps, ventilation fans, and farm lighting through relay-based switching mechanisms, thereby optimizing water and energy consumption. In addition, a GSM communication module facilitates remote monitoring and SMS-based notifications, allowing farmers to access operational information and manage field equipment from distant locations, while an LCD interface provides continuous visualization of environmental parameters and system status. Experimental implementation demonstrates significant improvements in water conservation, energy efficiency, operational reliability, and reduction of manual intervention, making the system a cost-effective and scalable solution for precision agriculture in resource-constrained environments. Furthermore, the proposed architecture establishes a strong foundation for next-generation Agriculture 4.0 applications through the integration of Internet of Things (IoT) connectivity, cloud-based data management, artificial intelligence (AI)-driven decision support, machine learning-based crop analytics, digital twin technology, drone-assisted field surveillance, and predictive maintenance frameworks. These advancements have the potential to transform conventional farms into autonomous, data-driven agricultural ecosystems capable of maximizing crop productivity, optimizing resource utilization, enhancing sustainability, and supporting the development of resilient smart farming infrastructures for future agricultural needs.

Keywords: *Smart Agriculture; Solar-Powered Farming; Arduino; IoT; Artificial Intelligence*

COMPUTATIONAL PHYSICS & APPLIED OPTICS

ICICET26IS2018T9

Design of Uni-traveling Carrier Photodiode for fiber to wireless optical transmitter

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ABSTRACT
The millimeter wave (MMW) bands are of great interest for wireless data transmission as these frequency bands offer large usable bandwidth [1,2] can easily be transported by radio over fiber (ROF) [3] from the central office to the multiple remote antenna unit (RAU) located at the base station [4]. Under such scenario base station transmitter design consists of designing wired to wireless transmitting node using a suitable device which can provide larger bandwidth compared to conventional device. This scheme exploits the advantage of wide band width signal carrying capability of the fiber. Uni- traveling carrier photodiode (UTC-PD) is emerging as an important device to be used in the base station for high frequency MMW photonic transmitter [1]. UTC photodiode-based photonic transmitter has shown the potential to be a key component for 75–180 GHz wireless transmission [2]. MMW photonic transmitter consists of a high-power and high band width photodiode build up with integrated amplifier and antenna on the same guiding structure. Such approach facilitates microcellular system [5], with several hundred meters diameter communication range promises for higher spectrum utilization and higher capacity.
To explore the usefulness of the device under many applications it is important to develop a model of UTC-PD device and optimize its performance. This model is used to analyze the performance of UTC-PD along with other integrated Radio Frequency (RF) devices in monolithic integrated circuit.

Keywords: *millimeter wave; frequency response; bandwidth; Uni- traveling carrier photodiode; photonic transmitter.*

ICICET26IS2040T9

Exploring the Architectural Transition of MOSFETs from Bulk to 3D

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ABSTRACT
Contemporary technological progress, linked to the semiconductor industries, worldwide, is mainly propelled by the intensified demands of the current consumer markets for high-performance electronic gadgets, which are characterized by the globally sought-after features like miniaturization enabling portability, cost efficacy, improved speed of operation and ameliorated low power performance. India's semiconductor landscape is also undergoing a noteworthy momentum owing to the nation's pragmatic approach towards transitioning from a simple consumer of electronics to a burgeoning global hub of semiconductor chip design. Being the fundamental building block of the semiconductor industry, MOSFET device has also undergone several technological advancements coupled with dimension scaling, over the decades, for enhanced performance gain. However, device dimension miniaturization, is also accompanied by numerous performance weakening short channel effects like threshold voltage reduction, drain-induced barrier lowering, deteriorated subthreshold swing, subthreshold leakage enhancement, degraded switching ratio etc., which pose as a major challenge for device design and performance upgradation. This has led to the catalysing of nascent research paradigms that have shaped

the trajectory for MOSFET architecture transition, from basic bulk to advance 3D architectures, for forthcoming cutting-edge technology realizations.

Keywords: *Semiconductor devices; MOSFET; Device miniaturization; Short channel effects; 3D MOSFETs.*

ICICET26IS2054T9

Design and Performance Prediction of Silicon Solar cells using AFORS-HET: A Review

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ABSTRACT
In recent decades the advancement in Photovoltaic (PV) devices as a sustainable solution to energy collapse has evolved with the researched materials for energy and the unique device design and configurations. With these innovations in materials science and technology the progress in conventional silicon based solar cells has emerged out with the design of silicon-based single junction, tandem and heterojunction (SHJ) solar cells, paving the way for high efficiency and stable devices. The review underscores the importance of theoretical simulations and based optimization for various device layers of SHJ structures prior to experimental fabrication to understand the required doping concentration, band alignment, interface passivation and nature of defects. The PV modeling ecosystem encompasses diverse simulation platform like AFOS-HET, SCAPS-1D for crystalline and thin-film cells, OghmaNano and Setfos for organic/perovskite devices with optical-electrical coupling, and 2D/3D tools like Sentaurus Device for large-area scaling analysis. These tools offer complementary physics formulations, material support along with the dimensional capabilities, enabling comprehensive pre-experimental optimization. The present article demonstrate the role of AFORS-HET as a key simulation tool in one-dimensional modelling of the solar cell layer parameters and highlights the importance of pre-experimental theoretical predictions in compressing the experimental space with inefficient trials. The review guides for the selection of optimized emitter and absorber for heterointerfaces in PV design to yield scalable high-performance modules.

Keywords: *AFORS-HET, Silicon Heterojunction (SHJ), Simulations, Device Modelling.*

COMPUTATIONAL CHEMISTRY & CHEMICAL INFORMATICS

ICICET26IS2033T10

Computational Exploration of Multicomponent-Derived Compounds: Docking, Drug Design and ADME Insights

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ABSTRACT
The efficient generation of structurally diverse and biologically relevant scaffolds remains a key objective in modern medicinal chemistry. In this work, a new series of heterocyclic compounds was synthesized via a multicomponent reaction approach. This one-pot strategy offers significant advantages, including operational simplicity, high atom economy, and the rapid construction of molecular complexity.

The synthesized compounds were structurally characterized using standard spectroscopic techniques, confirming the successful formation of the intended multicomponent-derived frameworks. To assess their potential as drug-like candidates, a comprehensive computer-aided drug design approach was employed.Preliminary predictions of biological activity were conducted using the PASS (Prediction of Activity Spectra for Substances) tool, offering important insights into the potential pharmacological properties of the compounds. Furthermore, molecular docking simulations were carried out with AutoDock Vina to evaluate their binding affinities and characterize their interaction profiles with selected biological targets.

Furthermore, pharmacokinetic parameters—including absorption, distribution, metabolism, and excretion (ADME)—were evaluated using the SwissADME web platform to assess drug-likeness and oral bioavailability. The findings indicate that several compounds demonstrate favorable binding interactions along with satisfactory pharmacokinetic profiles, highlighting their suitability for further structural optimization.

Overall, the study underscores the utility of combining multicomponent synthetic approaches with computational drug design techniques in the identification of promising molecular scaffolds for future drug development.

Keywords: *Computational Chemistry, Multicomponent Reactions, Drug Design, Molecular Docking, ADME predictions*

APPLIED MATHEMATICS & SCIENTIFIC COMPUTING

ICICET26IS2028T11

Modeling Magnetized Blood-Based Hybrid Nanofluids for Biomedical Applications: A Fractional Calculus and Neural Network Approach

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ABSTRACT

This study examines how a specially engineered hybrid nanofluid behaves under magnetic fields and thermal radiation in a confined channel. The fluid combines single- and multi-walled carbon nanotubes with graphene oxide, suspended in both blood and carboxymethyl starch as base fluids. Because biological and complex fluids exhibit memory-dependent flow characteristics, we used fractional calculusspecifically the Prabhakar derivative to model momentum and heat transfer more accurately. The governing equations were solved analytically using Laplace transforms and numerically validated with the Stehfest inversion method. To further test the reliability of our models, we trained an artificial neural network on the analytical data. The AI predictions closely matched the mathematical solutions, demonstrating high accuracy with minimal error. Our analysis shows that the blood-based hybrid nanofluid significantly outperforms the starch-based version in both heat dissipation and momentum transfer. We also mapped how magnetic intensity, thermal radiation, and fractional parameters shape fluid velocity and temperature profiles. Together, these results confirm that combining fractional modeling with machine learning offers a robust framework for predicting nanofluid behavior. Ultimately, this work highlights strong potential for applying SWCNT-MWCNT-GO hybrid nanofluids in targeted drug delivery, medical cooling systems, and high-efficiency thermal management devices.

Keywords: Hybrid nanofluid; Fractional calculus; Prabhakar derivative; Artificial neural networks; Magnetohydrodynamics; Heat transfer; Biomedical applications;

ICICET26IS2032T11

Fuzzy Computing in Industry 5.0: Intelligent Human-Centric Technological Transformation

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ABSTRACT
Industry 5.0 aims to build human-centered, sustainable and resilient industrial systems, where intelligent technologies complement human expertise instead of replacing it. However, modern industrial environments are often characterized by uncertainty, incomplete information, nonlinear processes and subjective decision factors that cannot be effectively addressed by conventional binary computing methods. This invited talk is intended to explore how fuzzy computing can be introduced as a practical and powerful mathematical framework for handling imprecision and supporting intelligent decision making in complex industrial environments. The talk will cover the fundamentals of fuzzy sets, rule-based reasoning and fuzzy optimization and their integration into Artificial Intelligence, Machine Learning, IoT, Cyber-Physical Systems, Cloud-Edge Computing, Robotics and Smart Manufacturing. The main applications include predictive maintenance, adaptive process control, quality assurance, human–robot collaboration, cybersecurity risk assessment, smart energy management and sustainable production planning. The findings reveal that fuzzy computing increases system robustness, interpretability, adaptability, and real-time operational performance in cases where precise analytical models are difficult to develop. Hybrid neuro-fuzzy and explainable AI approaches can also provide transparent and reliable intelligence that can be used to support Industry 5.0 goals. The talk concludes that fuzzy computing is an important link between applied mathematics and next generation industrial technologies, transforming uncertain data into useful knowledge and enabling safer, smarter, greener and more human-centered industrial ecosystems.

Keywords: Industry 5.0; Fuzzy Computing; Intelligent Decision-Making; Smart Manufacturing; Human–Machine Collaboration

ICICET26IS2036T11

Charge Gravastar in modified f(R, T) gravity

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ABSTRACT
A Gravastar (gravitational vacuum star) model is an alternative theory of Black hole. It was originally proposed by Mazur and Mottola in 2001. The advantage of a Gravastar over a black hole is the avoidance of the formation of singularities and event horizons, thereby avoiding some of the fundamental problems associated with classical black hole solutions. Gravastar is a gravitational collapse cold dark compact object composed of an interior de-sitter condensate phase () $\leq r \leq R_1$), a thin shell of stiff matter ($R_1 \leq r \leq R_2$) and an exterior schwarzchild vacuum region. We investigate the electromagnetic effect on the structure and stability of Gravastar in $f(R, L_m, T)$ gravity. The influence of electromagnetic fields on Gravastar configuration within the framework of modified gravity theory $f(R, T)$ gravity, which a non-minimal coupling between geometry and the trace of the energy-momentum tensor. The current study discusses how electric charge affects stability, mass-radius relation and energy conditions. The results obtained in this work indicate that electromagnetic contributions enhance the stability range and alter the pressure and density. The study furnishes new insights into charged compact objects in modified gravity frameworks.

Keywords: Charge Gravastar, Energy condition, stability, f(R, T) gravity

ICICET26IS2050T11

Influence of LTNE Effects on Nonlinear Convective Heat Transport in Composite Nanofluids

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ABSTRACT
The present study examines nonlinear convective heat transport in water-based hybrid nanofluids under local thermal non-equilibrium (LTNE) conditions. The governing conservation equations of the system are nondimensionalized with appropriate LTNE and nanofluid parameters. A weakly nonlinear stability analysis is performed in Mathematica to study the heat transport characteristics of the fluid layer. The results show that increasing the Nield number and the thermal diffusivity ratio suppress heat transfer, whereas the modified thermal capacity ratio enhances the weighted Nusselt number. The variations in nanofluid numbers; the modified thermal diffusivity ratio, the concentration Rayleigh number and the Lewis number have negligible effects. Non-metallic mono and hybrid fluids exhibit better heat transfer performance than metallic nanofluids. Furthermore, LTE and LTNE models display similar thermal response trends for different fluids, although the LTE system exhibit higher heat transfer compared to the LTNE system.

Keywords: Local thermal non-equilibrium (LTNE), composite nanofluids, weakly nonlinear analysis, conservation equations, Nusselt number.

ICICET26IS2053T11

Partial Differential Equations with Semi Analytic Iterative Methods

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ABSTRACT
We focus on linear and nonlinear partial, differential equations and we propose the numerical scheme using SAIM to obtain analytical approximate solutions to them.
To illustrate the potentiality of the approach, test problems are offered and the obtained numerical results are compared with the existing exact solutions and are depicted in terms of plots to reveal its precision and reliability. The SAIM method will be dedicated towards the exploration of partial and ordinary differential equations of different kinds and their evolution will be discussed. We present a reliable algorithm for solving, homogeneous or inhomogeneous, partial differential equations with initial conditions. The form of the solution is calculated as a series with easily computable components. Examples are considered for the numerical illustrations of this method. We will be considering and evaluating the initial and boundary value problems of partial and ordinary differential equations. This method has found application in different fields of nonlinear equations such as fluid mechanics and heat transfer.

Keywords: Numerical Solutions, Partial Differential Equations, Semi analytic methods

ICICET26SP1039T11

Analytical behaviour of SH waves in a cylindrical composite structure

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ABSTRACT
This work explores the dynamic propagation of shear-horizontal (SH) waves in a cylindrical structure composed of two concentric layers of homogeneous orthotropic materials. The main objective is to examine the effects of material anisotropy and geometric parameters on the dispersion characteristics of SH waves through cylindrical media. An exact dispersion relation is derived analytically using Bessel and Hankel functions by enforcing appropriate boundary and continuity conditions at the interface between the layers. To simplify the analysis and enhance computational efficiency, a closed-form approximation is also obtained through Debye's asymptotic expansion. Numerical investigations and graphical representations are conducted to validate the analytical formulation and to examine the impact of key factors, such as orthotropic elastic constants and the ratio of radii, on the dimensionless phase velocity with respect to the dimensionless wavenumber. The results indicate that both anisotropic material behaviour and structural geometry play a significant role in governing wave dispersion. In particular, changes in orthotropic parameters produce notable variations in phase velocity trends, emphasizing their importance in wave propagation studies. These outcomes are relevant to the analysis and design of cylindrical engineering applications, including composite pipes, subsurface tunnels, and waveguide systems.

Keywords: SH Wave, Cylindrical Structure, Orthotropic material, Bessel's function, Dispersion relation.

MATERIALS PROPERTIES & CHARACTERIZATION

ICICET26IS2014T12

Combination of Complex Geometrical Optics and Photothermal Beam Deflection Spectrometry for Determination of Materials Thermal Properties

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ABSTRACT
In this study the complex geometrical optics is applied for description of probe beam (PB) interaction with the field of temperature oscillations (TOs) in photothermal beam deflection (PBD) experiments. The analysis is performed for transverse PBD in its skimming configuration. PB propagates in the fluid layer over the samples surface in which TOs are induced. They lead to fluids refractive index changes (RIC) and refractive index gradients (RIG) that further introduce perturbations in PB amplitude and phase resulting in its intensity change.
Both one-dimensional (1D) and two-dimensional (2D) approaches of such obtained phototdeflection signals are developed and compared to indicate the advantages and limitations of their use.
Finally, the presented method is applied for characterization of freestanding graphene nanoplatelets and determination of their through-plane and in-plane thermal properties.

Keywords: *Photothermal techniques, Beam deflection spectrometry, Complex geometrical optics equations, Thermo-optical properties.*

ICICET26IS2034T12

Investigation of Weldability of AA6061 Aluminium Alloy Using Tungsten Inert Gas Welding and Study of Optimal Weld Joint Condition Using the Analytical Hierarchy Process

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ABSTRACT
One of the most widely used alloys is that of aluminium. Aluminium alloys find wide range of application due to improved properties such as light weight, corrosion resistance, high strength to weight ratio, high electrical and thermal conductivity. They are used in aerospace industries, robotics and engineering field. Some of the alloying elements include zinc, copper, manganese, magnesium, tin, silicon and nickel. Al-Si alloy, where Si is the primary alloying element is very widely used. One such alloy is AA6061 aluminium alloy, which contains around 0.6% silicon. Other elements present are magnesium, copper and chromium. It has good corrosion resistance, improved ductility and lower melting point. In this work, an attempt is made to investigate the weldability of AA6061 aluminium alloy using Tungsten Inert Gas (TIG) welding process with ER4043 as filler material and argon (99.99% pure) as shielding gas. Constant current TIG welding of A.C. polarity is used. Heat input (kJ/mm) and Gas flow rate (L/min) are the input factors of levels 0.322, 0.368, 0.423 kJ/mm and 10, 14, 18 L/min respectively. Central Composite Design (CCD) of Response Surface Methodology (RSM) is the design of experiment utilized. Output responses

considered are bead geometry (depth of penetration, bead width and height of reinforcement), hardness of weld zone measured in Rockwell hardness tester (B-scale) and presence of holes and cracks. Analysis of Variance (ANOVA) is applied to find the individual effect of each input factors on output responses. One of the important research aspects, is to find the optimal weld condition, which produces sound weld. The optimal weld condition during TIG welding of AA6061 aluminium alloy is obtained using the Analytical Hierarchy Process (AHP). It is a multicriteria decision making tool. It involves the selection of criteria based on output responses. Here, five criteria were selected, i.e. depth of penetration, bead width, height of reinforcement, weld bead hardness and presence of holes and cracks. Accordingly, criteria and alternative matrices are designed and weights are assigned to each of the matrices (from 1 to 9) based on the hierarchy of weights. Calculating the Global Weight of each alternative, it is observed that experimental run of heat input 0.322 kJ/mm and gas flow rate of 10 L/min yield the highest global weight of 0.1853. Thus, this is the optimal TIG welded condition. Study of microstructure of the optimal weld joint condition profile is performed by scanning electron microscopy (SEM).

Keywords: *Aluminium; Weldability; Tungsten Inert Gas Welding; Optimal; Microstructure.*

ICICET26IS2049T12

Structural relaxation, Conductivity Dynamics and Fractional Stokes-Einstein-Debye relation in Polyols: A Broadband Dielectric Investigation

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ABSTRACT

In the present work, the main relaxation behavior of three polyols viz. Glycerol, D-arabinose, D-xylose and D-lyxose have been studied using Broadband dielectric spectroscopy in a wide frequency and temperature range. The temperature dependence of primary relaxation times (τα), conductivity relaxation times (τσ), static permittivity (εs), Kirkwood correlation factor (gK) and orientational entropy (ΔS) have been critically examined. The current experimental results show that for all polyols, the log10σdc vs. log10τα dependence is nonlinear and hence does not follow Debye-Stokes-Einstein relation but can be well explained using the fractional-Stokes-Einstein-Debye relation.

Keywords: *polyols; dielectric relaxation, conductivity relaxation, Stokes-Einstein-Debye relation, Kirkwood factor.*

ICICET26IS2059T12

Investigation of Thermal, Electro-Optical and Dielectric Properties of Nematic Liquid Crystals Doped with Silver Nanoparticles

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ABSTRACT
Silver nanoparticle (Ag-NPs) doped liquid crystal structures have expanded considerable attention due to their competences for improving electro-optical and photonic performance. In the present work, we report a study of thermal, electro-optical and photoluminescence properties of the nematic liquid crystal EBBA (N-(4-ethoxybenzylidene)-4-butylaniline) doped with concentrations (0.1 wt% and 0.3 wt%) of Ag nanoparticles.
The thermal behaviour exhibited minor reductions in transition temperatures and enthalpy of both crystal to nematic and nematic to isotropic phases due to the doping of Ag nanoparticle. The decrease in enthalpy reproduced a slight disturbance of molecular order arising from weak interaction of Ag nanoparticle and liquid crystal molecules. Electro-optical observations show a substantial improvement in switching response for Ag-NPs doped EBBA nematic liquid crystal. The threshold voltage reduction and improved dielectric response were observed, ascribed to increased interfacial polarization and enhanced charge transport induced by the manifestation of metallic Ag nanoparticles. Photoluminescence studies exposed a marked growth in emission intensity without any momentous shift in the wavelength of emission. Localized surface plasmon resonance effects of Ag nanoparticles play a significant role in the enhancement of emission intensity. which increase radiative recombination efficiency within the liquid crystal matrix. Across the investigated concentration of Ag NPs, the 0.3 wt% Ag NPs doped sample showed more noticeable electro-optical enrichment and maintaining suitable optical transparency. Which was demonstrating an optimum doping value for liquid crystal devices.
Collectively the study reveal, the amalgamation of Ag nanoparticles into EBBA liquid crystals primes to upgraded thermal, electro-optical switching and photoluminescence behavior. These results establish that Ag-NPs doped EBBA structures are promising contenders for optical modulators, low-voltage liquid crystal devices and photonic applications.

Keywords: *Nematic liquid crystals, silver nanoparticles, dielectric behaviour and photoluminescence.*

MATERIALS SYNTHESIS & PROCESSING

ICICET26IS2035T13

Spectroscopic and Thermodynamic Insights into Charge Transfer Complexes of Thiadiazole Derivatives with DMAD

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ABSTRACT
Charge transfer (CT) complexes formed between heterocyclic donors and organic acceptors have attracted significant attention due to their promising applications in materials science, molecular electronics, and chemical sensing. Nitrogen- and sulphur-containing heterocycles, particularly 2-amino-1,3,4-thiadiazole derivatives, are of special interest owing to their strong electron-donating ability and structural versatility. In the present study, CT complexes of 2-amino-1,3,4-thiadiazole and its derivative, 2-amino-5-methyl-1,3,4-thiadiazole, with dimethyl acetylenedicarboxylate (DMAD) as an electron acceptor have been investigated in polar protic (methanol) and polar aprotic (DMSO) media at room temperature.

The formation of CT complexes was confirmed by the appearance of new absorption bands in the visible region in UV–Visible spectra, characteristic of donor–acceptor interactions. The stoichiometry of the complexes, determined by Job's method of continuous variations, revealed a 1:2 (donor:acceptor) ratio for 2-amino-1,3,4-thiadiazole and 1:1 for 2-amino-5-methyl-1,3,4-thiadiazole. The formation constants and molar extinction coefficients were evaluated using the Benesi–Hildebrand method. The negative values of standard free energy change (ΔG^o) indicate spontaneous and thermodynamically favourable complex formation.
Further structural insights into the CT interaction were obtained through spectroscopic techniques i.e. Infrared (IR), 1H NMR, 13C NMR and HRMS spectra.

Keywords: *Charge-transfer complex; UV-Vis spectra; Stoichiometry; Free energy change; Spectroscopic studies.*

ICICET26IS2055T13

Synthesis and characterization of Plant Oil-based Alkyd Resins and Nanocomposites for Multifunctional Surface Coating Applications

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ABSTRACT
Plant-based oils are increasingly used as raw materials for polymer resin and coating binders to replace petroleum-derived polymers in metals, and general protective coatings. These naturally occurring triglyceride oils are extracted from oil-bearing seeds, nuts, or fruit pulps via mechanical pressing, chemical solvent extraction, or a combination of these methodologies. Binder properties or coating performance of any the vegetable oils mainly depends on its fatty acid profile, iodine value, and the oil length. Thus, the starting materials of bio-based alkyd resins are plant-based seed oils of various compositions. This talk will focus on the overview of the plant oil-based research works carried out in our laboratory for multifaceted applications (Fig.1). Some of the plant seeds used as the raw material for the synthesis includes castor, shimalu, nahar, argemone etc. The talk will also discuss on characterizations of plant-based oils and their utilization as renewable raw material in polymer synthesis and newer product development.

ENERGY & SUSTAINABLE MATERIALS

ICICET26SP1122T14

Comparative Electrochemical Properties of APS- and $FeCl_3$-Mediated Polypyrrole Synthesis

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ABSTRACT
Polypyrrole (PPy) is one of the most extensively investigated conducting polymers as an electrode material due to its higher conductivity (>10^3 S cm^{-1}), facile synthesis method and low monomer cost. The electrochemical properties of PPy are significantly affected by its microstructure, morphology, electrical conductivity and presence of dopants. All these parameters can be tuned by selecting suitable oxidizing agent during the polymerization process. In this work, PPy with different morphology were prepared by using different oxidizing agents to control the doping level and conductivity of resulting polymer.

Structural and morphological investigation using XRD, FESEM and EDX revealed distinct particle size and network formation between the different PPy samples. Long interconnected sponge like fibrous polymeric chain with higher conductivity is synthesized by using ammonium persulfate (APS) whereas, $FeCl_3$ resulted in spherical shape polymer. Electrochemical investigation using cyclic voltammetry, galvanostatic charge-discharge and electrochemical impedance spectroscopy revealed favourable properties of lower solution and charge transfer resistance and enhanced ion diffusion for APS synthesized PPy which resulted in higher capacitance as compared with $FeCl_3$ synthesized PPy. Higher specific capacitance of 138 F/g at 1A/g in aqueous 3M KOH electrolytes is achieved in case of APS-based PPy when compared to 99 F/g at 1A/g exhibited by $FeCl_3$ based PPy. This demonstrates that selection of oxidizing agent is a crucial factor for tailoring the electrochemical properties of PPy, providing valuable insights in developing high-performance conducting polymer-based electrodes for next-generation supercapacitors.

Keywords: *Supercapacitor; conducting polymers; polypyrrole; doping; ammonium persulfate, ferric chloride*

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Analytical Elucidation of the Photophysical Origins of Open-Circuit Voltage in Dye-Sensitized Solar Cells

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ABSTRACT
This work presents an extensive theoretical investigation into the fundamental mechanisms responsible for the development of open-circuit voltage in solid-state dye-sensitized solar cells (DSSCs). A rigorous analytical framework is formulated through the simultaneous consideration of drift–diffusion equilibrium and the dynamic interplay between charge generation and recombination phenomena. The derived theoretical model successfully characterizes the voltage behavior of the system and provides deeper insight into the intrinsic photovoltaic processes influencing device performance.
The analysis reveals that the open-circuit voltage exhibits a logarithmic enhancement with increasing illumination intensity, approximately proportional to 1.7kT/q, where k denotes the Boltzmann constant, T represents the absolute temperature, and q signifies the elementary electronic charge. This behavior is attributed to the disproportionate escalation of photogenerated charge carriers relative to the recombination rate, resulting in an elevated chemical potential throughout the active medium. Conversely, the model predicts a decline in photovoltage with increasing operational temperature and active-layer thickness, indicating the dominant influence of recombination kinetics and internal energy dissipation mechanisms.

ICICET26IS2048T14

Waste to Energy: Sustainable Bio-Fuel Production from Kitchen Waste via A Novel Catalytic Route

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ABSTRACT

The increasing generation of kitchen waste poses serious environmental challenges while simultaneously offering a sustainable feedstock for renewable energy production. This study investigates the conversion of kitchen waste, including fruit peels, vegetable residues, and other biodegradable organic matter, into biofuel through an integrated biological and chemo- catalytic process. Initially, the waste biomass was chemically pretreated to break down complex lignocellulosic and starch-rich structures into fermentable sugars. The hydrolysate was subsequently subjected to microbial fermentation, where biological catalysts converted the released sugars into ethanol. The combined catalytic approach enhanced biomass utilization, improved ethanol yield, and reduced processing time compared to conventional methods. The produced bioethanol was characterized to evaluate its quality and fuel potential. The process not only generated a valuable renewable fuel but also significantly reduced the volume of organic waste destined for landfills. From a sustainability perspective, the utilization of kitchen waste as a feedstock contributes to greenhouse gas mitigation, decreases dependence on fossil fuels, and promotes a circular economy through waste valorisation. Furthermore, a life-cycle assessment indicated that the proposed waste-to-bioethanol pathway offers environmental advantages over traditional waste disposal practices by reducing carbon emissions and recovering energy from otherwise discarded biomass. Overall, this study demonstrates that the integration of chemical pretreatment and biological fermentation provides an efficient, economical, and environmentally sustainable route for bioethanol production from kitchen waste. The proposed approach addresses both waste management and renewable energy challenges, supporting the transition toward cleaner and more sustainable energy systems.

Keywords: *Kitchen waste, Bio-Fuel, Catalysis, Waste Valorisation, Renewable energy*

ICICET26IS2051T14

Next-Generation $BaZrS_3$ Chalcogenide Perovskites Absorbers for High-Efficiency Thin-Film Solar Cells

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ABSTRACT
A breakthrough category of absorber materials in single-junction thin-film solar cells is the chalcogenide perovskites, such as BaZrS3, with a near-ideal bandgap of 1.75 eV, very high absorption coefficients of up to 105 cm-1, and much better tolerance of defects than oxide perovskites. This is a review of recent progress in BaZrS3-based photovoltaics, where theoretical efficiencies of over 30% are achieved through band-tail recombination repression and p-type doping.

Its major strengths are earth-abundant, non-toxic composition, high carrier mobilities (>10 cm2/Vs), and thermal stability up to 600o C, overcoming the drawbacks of lead-based halides. The simulations of devices achieve PCEs that are optimized by over 25% with ETL/HTL interfaces. Other problems like phase instability, and scalability are strongly analyzed in conjunction with the emerging solutions like alloying with CaZrS3. BaZrS3 promises sustainable and high performance solar energy harvesting.

Keywords: *$BaZrS_3$, Chalcogenide perovskites, Thin-film solar cells, Defect tolerance, Photovoltaic absorbers*

ELECTRONIC, PHOTONIC & QUANTUM MATERIALS

ICICET26IS2046T15

Unconventional Magnetic Property of a Quasi 1D Antiferromagnet

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ABSTRACT
Quantum materials with complex magnetic interactions provide a fertile platform for modern quantum technologies, as emergent magnetic states can enable novel functionalities for quantum sensing, spintronics, and quantum information processing. These materials exhibit emergent electronic and magnetic phenomena arising from strong correlations, topology, and competing interactions, while geometric frustration often stabilizes unconventional ground states and exotic collective excitations. In this context, understanding the interplay among crystal structure, magnetism, and electronic properties is essential for establishing structure–property relationships in condensed matter systems. In low-dimensional materials, geometric frustration frequently gives rise to unconventional physical behaviour. Here, we investigate the ground-state properties of the low-dimensional Kondo lattice compound Ce_3ZrBi_5, which crystallizes in a hexagonal quasi-one-dimensional structure. Experimental observations reveal pronounced heavy-fermion characteristics accompanied by a suppression of the Ce 4f magnetic moment. Magnetization measurements identify two successive antiferromagnetic transitions at 4.8 K and 4.1 K. The in-plane magnetization exhibits typical antiferromagnetic behaviour at low magnetic fields, while a tendency toward saturation appears at higher fields. Density functional theory calculations indicate an enhanced electronic density of states along the Bi linear chains. Enhanced Kondo screening along the c-axis results in a quenched easy-axis magnetic ground state. Interestingly, the out-of-plane magnetization displays signatures of fractional magnetization plateaus, suggesting frustration-driven exotic magnetic phases. These findings provide a rare example of selective fractionalization emerging from geometric frustration in a strongly correlated quantum material.

Keywords: *Magnetism; Quantum materials; Single crystals; Electronic structure; Kondo physics.*

STRUCTURAL & BIOMEDICAL MATERIALS

ICICET26IS2038T16

Synthesis And Characterization of Synthesized Metal Nanoparticles from Leaf of Phyllanthus Acidus L.: In Vitro and in Silico Interaction with Gultathione–S-Transferase of Aedes Albopictus

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ABSTRACT

In the current study, metal nanoparticles (MNPs) such as silver, copper oxide, iron oxide, and zinc oxide were synthesized using aqueous leaf extract from the Phyllanthus acidus L. plant. These MNPs were then characterized and their efficacy against early third instar of Aedes albopictus was evaluated. Characterization studies confirmed a face-centered cubic crystalline structure of the nanoparticles, while transmission electron microscopy (TEM) and dynamic light scattering (DLS) analyses revealed average

particle sizes of 50, 52.33, 40.56, and 79.45 nm for silver, copper, iron and zinc nanoparticles, respectively. Field emission scanning electron microscopy (FE-SEM) analysis indicated agglomerated and clustered surface morphology of the MNPs, and each nanoparticle's production and elemental composition were ascertained using energy-dispersive X-ray (EDX) analysis. Larvicidal bioassays conducted at concentrations of 1, 5, 10, 15, and 20 ppm demonstrated that silver nanoparticles exhibited the highest efficacy compared to the other nanoparticles, with the order of activity being Ag > Feo > CuO > ZnO against Aedes albopictus. Biochemical analysis revealed a significant reduction in glutathione S-transferase (GST) activity in larval homogenates following exposure to MNPs. Furthermore, molecular docking studies were performed to evaluate the binding affinity of selected phytocompounds (ligands) with two target enzymes of Aedes albopictus, namely Delta and Epsilon classes of GST. Overall, the findings indicate that MNPs synthesized using P. acidus leaf extracts possess strong larvicidal potential and may serve as effective eco-friendly agents for controlling the population of Aedes albopictus.

MATERIALS FOR ADVANCED DEVICES & EMERGING TECHNOLOGIES

ICICET26SP1003T17

A Material-Driven Optimization Framework for High-Performance Permanent Magnet Linear Synchronous Motors

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ABSTRACT

This paper presents the comparative technical as well as economical analysis of the various grades of electrical steel materials used in the stator core of the Permanent Magnet Rotor Linear Synchronous Motor (PMRLSM). The analysis was carried out on the four widely used electrical steel materials: M50, M27, M14, Standard GOES, and HI-B. The analysis was done considering the key parameters such as conductivity, core loss density, force generated on the rotor and the cost factor for each of the cases considered. An algorithm was created to calculate the efficiency factor using the customized formula considering the electromagnetism and the properties of the materials used in the construction of the motor. The motor considered in the analysis is a 12-slot motor with 150 turns per slot using 20 SWG copper wire as the conducting material and the permanent magnet-based rotor with a supply current of 10A. The analysis also includes the development of the cost calculation model to determine the total raw as well as operational costs of the motor using the electrical steel materials considered in the analysis. The analysis revealed that the HI-B steel outperformed the other variants of the electrical steel materials considered in the analysis by offering the best balance between the minimum values of core loss density, conductivity and the force generated on the rotor thus offering the minimum costs of operation as well as raw materials. The framework developed can be considered the best tool for decision-making regarding the selection of the best variant of the electrical steel materials used in the construction of the high-efficiency linear motors.

Keywords: *PMRLSM, HI-B steel, FEMM, FEA, Linear Motor Optimization*

ICICET26IS2066T17

Thermoelastic Damping of Doubly-Clamped Micromechanically Modelled PTFRC Microbeams

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ABSTRACT
A micro-mechanical model of piezothermoelastic fiber-reinforced composite (PTFRC) materials is presented using Strength of Materials and Rule of Mixtures. Thereafter, some electro-thermoelastic properties of the PTFRC are graphically demonstrated and their advantages and potential applications are discussed. Then, thermoelastic damping in a doubly-clamped micro-scale PTFRC beam is analyzed considering the linear Euler-Bernoulli theory. The eigenvalues of the beam are calculated numerically using the Newton-Raphson technique. The Classical dynamical coupled, Lord-Shulman, and Green-Lindsay thermoelasticity theories are exclusively analyzed. The effects of thermal relaxation parameters, fiber volume fraction, micro beam dimensions, and beam modes on the TED are graphically illustrated. For high values of fiber volume fraction, the PTFRC beam has superior electro-mechanical-thermal properties and greater quality-factors compared to the monolithic beam. However, the quality-factor increases as the fiber volume fraction decreases. This facilitates the choice of a suitable value of fiber volume fraction for designing and optimizing frequency-sensitive MEMS PTFRC beams.

Keywords: *Piezothermoelastic fiber-reinforced composite; Thermoelastic damping; Micro-scale clamped beam; Thermal relaxation times; MEMS/NEMS.*

Materials Science & Computational Materials

ICICET26IS2005T18

Sustainable C–H Activation Cyclization for Carbazole Synthesis Using Palladium Nanoparticles in Aqueous Medium

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ABSTRACT
Efficient and sustainable strategies for the synthesis of nitrogen-containing heterocycles such as carbazoles and N-arylindoles have been developed using metal-catalyzed C–N and C–H bond forming reactions. A practical approach for the synthesis of functionalized carbazoles was achieved through consecutive **Cu-catalyzed Chan–Lam N-arylation** of *o*-iodoanilines with boronic acids followed by **Pd-catalyzed intramolecular aryl C–H activation**, where **1,8-diazabicyclo[5.4.0]undec-7-ene (DBU)** acts as both base and ligand to improve yields and functional group tolerance. Microwave-assisted Pd-catalyzed reactions significantly reduced reaction time and enabled the synthesis of various substituted carbazoles, including naturally occurring alkaloids such as **clausine L** and **clausine H**, while also providing access to compounds like **4-acetylcarbazole**. In addition, selective synthesis of **N-arylindoles** was accomplished via **carbopalladation–cyclization reactions** of 2-halo-N-arylanilines with alkynes under microwave irradiation, producing a wide range of indole derivatives with high chemoselectivity and regioselectivity. Furthermore, an environmentally friendly method using **surfactant-stabilized palladium nanoparticles in water** was developed for aryl C–H activation, allowing the synthesis of up to **43 carbazole derivatives** in excellent yields (up to 99%) under mild conditions. Photophysical studies revealed that carbazoles interact strongly with **calf-thymus DNA through groove binding**, supported by molecular docking analysis.

These methodologies provide rapid and green synthetic routes to biologically important carbazole and indole frameworks, which are widely used in **pharmaceuticals, natural product synthesis, and medicinal chemistry**. The strong **DNA-binding ability** of certain carbazole derivatives highlights their potential in **drug discovery, anticancer research, and molecular recognition studies**. Additionally, the use of **microwave irradiation, recyclable Pd-nanocatalysts, and water as a green solvent** supports the development of sustainable and efficient strategies for the synthesis of functional heterocyclic compounds with applications in **organic electronics, materials science, and biomedical research**.

Keywords: *C-H activation; Carbazoles; Pd-nanocatalysts; Water;*

INTELLIGENT MECHANICAL SYSTEMS & DIGITAL MANUFACTURING

ICICET26SP1035T19

Design and Implementation of a Real-Time Geofencing-Based Smart Attendance and Bus Tracking System for Educational Institutions

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ABSTRACT
Traditional college bus management systems often suffer from manual attendance errors and uncertainty regarding bus arrival times, leading to student dissatisfaction and administrative overhead. This paper presents KARE BT, a robust, real-time tracking and automated attendance system developed for Kalasalingam Academy of Research and Education. The system leverages GPS Geolocation, the Haversine formula for geofencing, and Firebase's real-time synchronization to provide live bus tracking with sub-3-second latency. A key innovation is the 'Smart Attendance' module, which automatically logs student presence when the bus enters a predefined geofence around a virtual bus stop.
Furthermore, the system integrates the Open-Source Routing Machine (OSRM) API to provide road-accurate Estimated Time of Arrival (ETA). Experimental results show high accuracy in attendance logging and significant improvements in commute predictability for students

Keywords: *Real-Time Tracking, GPS, Geofencing, Firebase, Smart Attendance, Haversine Formula, OSRM API, React, Capacitor*

ICICET26SP1061T19

Magnetic Levitation Based Frictionless Bearing System

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ABSTRACT

Magnetic Levitation (MagLev) based frictionless bearing systems represent a significant advancement in modern mechanical and electromechanical engineering. Unlike conventional bearings that rely on physical contact between moving components, magnetic bearings utilize controlled magnetic forces to suspend and support rotating shafts without direct contact. This eliminates mechanical friction, reduces wear and tear, minimizes maintenance requirements, and enhances operational efficiency. The proposed system employs electromagnets, position sensors, and a feedback control unit to maintain stable levitation of the rotor during operation. Real-time monitoring and control ensure accurate shaft positioning and dynamic stability under varying load conditions.

The frictionless nature of the system enables high-speed rotation with reduced energy losses, making it highly suitable for applications such as turbines, compressors, flywheel energy storage systems, precision manufacturing equipment, and aerospace machinery. Furthermore, the absence of lubrication requirements contributes to cleaner operation and improved environmental sustainability. This study explores the design principles, working mechanism, control strategies, advantages, and challenges associated with magnetic levitation bearings. Performance parameters including load capacity, vibration reduction, efficiency improvement, and system stability are analyzed. The findings indicate that magnetic levitation technology offers a reliable and energy-efficient alternative to conventional bearing systems, particularly in applications demanding high precision, long service life, and minimal maintenance. Future developments in power electronics and intelligent control systems are expected to further enhance the performance and commercial viability of frictionless magnetic bearing technologies.

Keywords: *Magnetic Levitation, Frictionless Bearing, Electromagnetic Suspension, Active Magnetic Bearing, Rotor Dynamics, Position Control, Energy Efficiency, High-Speed Machinery.*

BIOMEDICAL DEVICES, MEDICAL IMAGING & HEALTHCARE INFORMATICS

ICICET26IS2022T20

A Cost-effective AI-Assisted Multilingual Pipeline for Pre-Procedure Counselling

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ABSTRACT
Background: Pre-procedure counselling is essential for informed consent and patient preparation, but language barriers and limited health literacy can reduce patient understanding. Although patients may use consumer translation tools independently, ad hoc self-translation can be inaccurate, inconsistent, and unable to ensure preservation of clinical meaning. We evaluated an AI-assisted workflow to create multilingual counselling content for percutaneous liver biopsy as a low-cost yet effective proof of concept.
Methods: We designed a low-cost healthcare AI pipeline integrating LLM-based English grade-level simplification, machine translation, human post-editing, back-translation, bilingual semantic validation, harmonization, and readability scoring. Fidelity was established using a framework adopted from the Professional Society for Health Economics and Outcomes Research's (ISPOR) principles of good practice for translation and cultural adaptation. A widely used English source document on percutaneous liver biopsy from the authors' home institution was simplified into lower-reading-level English using OpenAI's ChatGPT (version 5.4, Thinking variant), then adapted into Hindi, Telugu, and Bengali using Google's Gemini (version 3, Fast variant). Readability was measured with Flesch-Kincaid Grade Level (FKGL). Accuracy of translation was tested by speakers proficient in both English and the translated language.
Results: The original English text had an FKGL of 7.99, while the simplified English script had an FKGL of 4.80, an improvement of 3.19 grade levels. Across all three translated versions, essential clinical meaning was preserved in the domains of purpose, preparation, risks, procedural steps, after-care, and results, with conformance to the proof-of-concept fidelity rubric.
Conclusion: This low-cost AI-assisted pipeline may provide a scalable and reliable approach to multilingual pre-procedure counselling in resource-constrained settings.

Keywords: *Patient Consent; LLM; ISPOR; Liver biopsy.*

ICICET26IS2030T20

Integrative Network Pharmacology and Docking Analysis of Hemidesmus indicus Phytochemicals against Diabetic Nephropathy

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ABSTRACT
Diabetic nephropathy is a microvascular complication of diabetes mellitus that subsequently results in end-stage renal disease (ESRD). Conventional treatment strategies have failed to provide a permanent solution to this chronic debilitating condition. Literature supports the application of herbal remedies in diabetic nephropathy. The roots of Hemidesmus indicus are widely recognized for their therapeutic

properties. The present study exploited an in silico approach to elucidate the potential of the phytochemicals identified from H. indicus roots in managing this chronic condition. A total of 14 bioactive compounds were retrieved from the IMPPAT database, and ADMET analysis revealed 7 compounds had acceptable drug-likeness and physicochemical characteristics. Furthermore, the potential targets of these 7 compounds were overlapped with the diabetic nephropathy-related genes. Protein–protein interaction analysis of these 188 overlapping genes, computed by STRING and Cytoscape, revealed a highly interconnected network, with 677 edges and an average node degree of 7.2. Cytohubba demonstrated 10 hub genes, including SRC, EGFR, PIK3CA, PIK3R1, JAK2, PTPN11, PTK2, AKT1, KDR, and PIK3CG. KEGG pathway analysis identified significant enrichment in pathways such as Insulin resistance, PI3K-Akt, RAS, EGFR, and AGE–RAGE signaling. Molecular docking analysis revealed a promising affinity of the phytochemicals for AKT1, JAK2, PTK2, PIK3R1, KDR. Overall, the findings provide mechanistic insights into the activity of H. indicus root phytochemicals against diabetic nephropathy and establish a scientific basis for their therapeutic validation.

Keywords: *Diabetic nephropathy; Hemidesmus indicus; In silico; Molecular docking; Network pharmacology.*

ICICET26IS2031T20

Early and Accurate Non-Invasive Detection of Breast Tumour Using a Novel UWB Radar Pulse

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ABSTRACT
Impulse Radio Ultra-Wideband (IR-UWB) is emerging as a promising breast cancer detection technique due to its high resolution, non-ionizing nature, effectiveness in dense breast tissues, and cost-effectiveness compared to conventional imaging methods such as ultrasound, magnetic resonance imaging, and X-ray mammography. Radar-based UWB technology provides a non-invasive approach for early and accurate detection of deep-seated malignant tumors while ensuring compliance with Federal Communication Commission (FCC) safety regulations.This research proposes a radar-based breast cancer detection system using a seventh-order shaped Gaussian UWB pulse. A sharp transition bandpass Finite Impulse Response (FIR) pulse shaper filter is designed to achieve safe penetration, reduced interference, low side-lobe levels, and improved spectral efficiency while closely fitting the FCC spectral mask. The proposed pulse shaping enhances antenna radiation efficiency by concentrating power within the main lobe.Both monostatic and bistatic radar configurations are employed for detecting small and deep-rooted tumors. Tumor identification is performed through time-domain and frequency-domain analysis of backscattered signals, where variations in signal amplitude, electric field intensity, and scattering parameters indicate the presence of malignant tissues. Simulation results demonstrate significant differences between normal and malignant breast tissues for tumor sizes ranging from 4 mm to 0.5 mm.Specific Absorption Rate (SAR) analysis is carried out to accurately localize tumors by identifying maximum energy absorption regions. The study also investigates age-dependent heterogeneous breast models, revealing increased SAR values in malignant tissues due to higher dielectric contrast. Numerical simulations using CST Microwave Studio and experimental validation using a fabricated tumor-affected breast phantom in an anechoic chamber show strong agreement, confirming the effectiveness of the proposed approach for early breast cancer detection.

Keywords: *Early Breast Cancer Detection; Specific Absorption Rate; Ultra-Wideband Pulse Propagation; Ultra-Wideband Pulse Shaping Filter; Ultra-Wideband Radar.*

ICICET26IS2045T20

Image Enhancement through Edge Preservation: A Multi-Level Hybrid Denoising, Ridgelet and Curvelet Based Technique

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ABSTRACT

Medical image is one of the most power full tools for studying neurological disorders. Epilepsy is one of the frequently observed neurological disorders. Here the medical image can used to study the epilepsy. Further the image pre-processing (noise removal, image enhancement) plays a significance role to enhance the quality of the given input image. Furthermore an efficient real time embedded solution for medical image enhancement is needed for further processing of the given images.

In this proposes work, an image enhancement technique based on wavelet, ridgelet and curvelet transform has been introduced. Here a modified Haar wavelet transform with sliding window-based overlapping execution is use for image denoising with a dedicated embedded hardware implementation. The proposed algorithm provides a ridgelet and curvelet transform based solution for image enhancement by image's edge preservation.

Performance of the projected image enhancement algorithm has been evaluated in terms of many statistics approached namely peak signal-to-noise ratio-(PSNR), mean square error-(MSE), mutual information-(MI), universal image quality index-(UIQI), geometric mean-(Gm), and gradient-(Gd). The results obtained by applying the projected algorithm demonstrate the significant improvement in output image quality.

The embedded implementation of the proposed algorithm into an ESP32-WiFi-Cam-Module provides a real time potable solution. Further it has been observed that the in-place calculation with software pipelining technique offers memory and time efficient solution. Furthermore, lower computational overhead results in fewer resource requirements which make the proposed solution suitable for real time and portable.

Keywords: *Curvelet, Edge Preservation, Embedded System, Multi Level Denoising, Ridgelet, Wavelet*

ICICET26SP1032T20

Digitalized separation by ultrafiltration membranes with electrotunableIpore-size and charge

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ABSTRACT

Dynamic control of molecular transport through membranes is essential for efficient industrial and biomedical processes, but conventional membranes are limited by static membrane structures. Stimuli-responsive membranes can offer a route to adaptive transport triggered by various stimuli such as temperature, pH, and others. In particular, electrotunable membranes are more desired in practical separation processes, enabling a broadly applicable route to digitalize separation science. Here, we introduce electrochemical osmotic (ECO) actuator membranes. These hydrogel nanocomposites consist of a cellulose nanofibril (CNFs)-carbon nanotube (CNT) network capable of rapidly, precisely, and energy-efficiently adjusting pore size and membrane charge through low-voltage-driven uniaxial shape-morphing, enabled by dynamic covalent hemiacetal crosslinking. ECO membranes provide large actuation strains, mechanical durability, self-sensing for closed-loop control, and, notably, retain their state after removal of stimulus. By electronically tuning membrane pore size and charge, we demonstrate programmable release of small molecules and a digitally tunable molecular weight cut-off to separate PEG (4–70 kDa), corresponding to an effective pore radius of 2–8 nm, which overlaps with the size range of many protein therapeutics and bioprocess-relevant biomolecules. These electrotunableultrafiltration (eUF) membranes pioneer next-generation separation technology by offering a digitally responsive platform for smart therapeutic delivery and adaptive separation.

ICICET26SP1105T20

*Beyond Waste Classification: A Risk-Aware Bio*medical Waste Management Framework Integrating Multi-Modal Sensing and Automated UV Sterilization

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ABSTRACT

Biomedical waste management is a growing concern due to the increasing volume of hazardous waste generated by hospitals, diagnostic laboratories, and healthcare facilities. Improper segregation and handling of biomedical waste can lead to environmental pollution, occupational hazards, and the spread of infectious diseases. Although several automated waste management systems have been developed, most existing approaches primarily focus on waste classification using image processing or basic sensor-assisted segregation. These systems often lack the ability to assess contamination severity and perform appropriate treatment before disposal, limiting their effectiveness in managing potentially infectious waste. To address these challenges, this paper proposes a prototype-scale intelligent biomedical waste management system that integrates multi-modal sensing, risk assessment, and automated sterilization

within a unified framework. The proposed system utilizes an ESP32-CAM module along with gas, moisture, color, and environmental sensors to capture both visual and non- visual characteristics of biomedical waste. Sensor fusion techniques improve classification accuracy and reduce the limitations of image-only approaches. Based on the collected sensor data, a Biomedical Risk Index (BRI) is generated to estimate the contamination level and hazard potential of each waste item.

A key feature of the proposed framework is the incorporation of a risk-driven sterilization stage. Waste identified as moderate- or high-risk is automatically directed to a UV-C sterilization chamber before final segregation and disposal. This intermediate disinfection process minimizes microbial contamination, reduces human exposure to infectious materials, and enhances overall waste-handling safety.

The current work focuses on developing and validating a functional prototype using commercially available components. The framework is designed for future scalability and can be extended with industrial-grade controllers, edge AI processors, robotic handling systems, cloud-based monitoring platforms, digital waste traceability, and advanced sensing technologies. By integrating intelligent sensing, risk-aware decision-making, and automated sterilization, the proposed system provides a foundation for safer, more efficient, and sustainable biomedical waste management.

Keywords: *Risk-Aware Biomedical Waste Management, Biomedical Risk Index (BRI), Multi-Modal Sensor Fusion, UV-C Sterilization, Intelligent Waste Segregation.*

SMART AGRICULTURE & AGRI-TECHNOLOGIES: ADVANCES IN AGRICULTURE, AND ALLIED SCIENCES

ICICET26SP1110T21

Solar-Aware Mission Scheduling for Long-Endurance Precision Agriculture Using Fixed-Wing UAVs

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ABSTRACT

Unmanned aerial vehicles (UAVs) are increasingly used in precision agriculture because they provide flexible, high-resolution crop monitoring. However, battery endurance constrains large-area surveys, repeated monitoring and remote farm operations. Solar-assisted UAVs can extend endurance by harvesting photovoltaic energy during flight, but their mission planning must jointly account for crop priorities, solar irradiance, battery state of charge, payload demand, imaging constraints and safe return-to-home reserve. This paper proposes a solar-aware mission scheduling framework for a fixedwing UAV dedicated to precision agriculture. The framework integrates a photovoltaic energy model, battery dynamics, zonepriority monitoring, image-quality constraints and a safetyaware scheduling rule. A Mission Agro-Energy Feasibility Index (MAEFI) is introduced to quantify whether an agricultural monitoring mission is energetically safe and agronomically useful. A reproducible numerical case study is conducted on a 120- ha field divided into 12 crop-monitoring zones. Three strategies are compared: battery-only baseline, distance-optimal coverage planning and the proposed solar-aware priority scheduler. Results show that the proposed scheduler increases field coverage from 68.4% and 81.7% to 94.6%, increases priority coverage from 64.1% and 76.3% to 97.5%, and maintains a final battery state of charge of 55.3% while preserving a 20% safety reserve.

Keywords: *solar-powered UAV; precision agriculture; multispectral imaging; energy-aware planning; battery management.*

ICICET26IS2007T21

Effect of Iron and Zinc Nanoparticles Synthesized via Green Route on Grapevine cv. Nanasaheb Purpledigital Transformation in Arts, Humanities, Social Sciences, Management, Economics & Sustainable Development Systems

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ABSTRACT

Eco-friendly nanoparticles of iron and zinc were synthesized through novel green route using Manjari Medika pomace. The appearance of well-defined peaks at 433.98 and 518.85 cm-1 were due to iron-oxygen (Fe-O) bond which confirmed the nanoparticles were iron oxide. The size of iron nanoparticles was found to be 74.52 nm. The FTIR peaks of Zn-NPs at 406.05, 835.18 and 879.54 cm-1 indicated Zn-

O stretching vibrations, the peak at 2322.29cm-1 was ascribed to C≡C stretching vibration. The mean particle size was 90.67 nm. Field experiment results revealed percent increase in berry iron content was +25.47 and 38.75% at veraison and harvest stage of Nanasaheb purple variety. The corresponding values for percent Zn increase was +34.33 and 48.75% in berries at veraison and harvest stage.

Keywords: *Nanoparticles; iron; zinc; grapes; particle size analysis.*

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An Extensive Review on Sensor Technologies for Monitoring Soil Health

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ABSTRACT
Soil health monitoring is essential for improving crop yields, reducing negative environmental effects, and supporting sustainable farming methods. This review highlights recent progress in sensor system technologies and explores their significant impact on advancing precision agriculture. For real-time irrigation management, dielectric-based moisture sensors (TDR, FDR) and remote sensing methods have shown great efficacy, whereas ion-sensitive field-effect transistors (ISFETs) and optical systems have improved. Enhanced pH and EC monitoring for nutrition profiling is always required. Data-driven decision-making is supported by the integration of sensors into IoT-enabled networks, which enables comprehensive, real-time data collecting and predictive analytics. Despite these developments, significant obstacles still exist, such as the requirement for soil-specific calibration, exorbitant expenses, and poor connection in isolated locations. Soil sensor technology is developing from simple devices to complex systems that can identify particular ions and biological activity. Prospects for the future depend on creating robust, affordable sensors with universal calibration models, using biodegradable materials to improve sustainability, and utilizing machine learning for predictive analytics. In addition to highlighting the trans-disciplinary advances needed to close the gap between prototype and large-scale implementation in global agriculture, this analysis emphasizes the critical role sensor technologies play in attaining sustainable soil management.
Keywords: *Soil sensors, agriculture, Soil health, Biosensors, Nanosensors*

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CashewAppleGradeAI: YOLOv8-Driven Visual Intelligence for Harvest Readiness

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ABSTRACT
High spoilage rates due to rapid deterioration of cashew apples are an issue for farmers who rely on manual looks to assess ripeness for harvest (time-consuming, inconsistent, not scalable). This paper describes a lightweight intelligent system that detects the fruit on images, assesses ripeness level and quality, and indicates optimal harvest timing. The system begins with a pre-trained object detector for apple localization, YOLOv8, trained on field photographs of outside orchards in diverse lighting conditions. It then segments the detection using HSV thresholds so that ripeness is determined as a percentage, binning this value into unripe/halfway/yellow and fully ripe/ready for harvest. It also segments any a priori-unwanted object on the detection such as dark spot/ colored spot/ peel curdling or skin roughness for quality assessment. It is available as a web app that runs on phones through the camera, requiring no additional equipment. In trials on orchard images, detection accuracy was 92%,

ripeness assessment was within 5% and waste was reduced by 30%. This system simplifies and expedites harvest, reduces waste, and delivers better fruit to market.

Keywords: *Cashew apple, Ripeness detection, YOLOv8, Quality assessment, Smart agriculture.*

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Smart IoT Greenhouse: Automated Environmental Control System for Sustainable Agriculture

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ABSTRACT
Agriculture is essential for sustaining human life; however, traditional farming methods often depend on manual monitoring and environmental uncertainty, which can reduce crop productivity and lead to inefficient use of resources. This project presents a Smart IoT Greenhouse: Automated Environmental Control System for Sustainable Agriculture, designed to create and maintain optimal growing conditions using embedded electronics, automation, and Internet of Things (IoT) technology.The proposed system continuously monitors critical environmental parameters including temperature, humidity, soil moisture, light intensity, and air quality through integrated sensors. Based on real-time sensor feedback, the system automatically controls irrigation, lighting, and ventilation to maintain favorable conditions for plant growth. An Arduino-based controller performs local automation, while an ESP32 module transmits live data to a mobile or web-based IoT dashboard for remote monitoring and manual control. This dual-controller architecture ensures reliable operation even during internet interruptions.The system aims to reduce manual labor, conserve water through smart irrigation, and improve agricultural efficiency by enabling precision-based environmental control. Its low-cost design makes it suitable for small-scale farmers, urban agriculture, and educational demonstrations. The project promotes sustainable farming practices and demonstrates the practical application of IoT and automation in modern agriculture, contributing toward improved crop productivity and resource-efficient food production.

Keywords: *Smart Greenhouse; Internet of Things (IoT); Sustainable Agriculture; Environmental Monitoring; Automation.*

DIGITAL TRANSFORMATION IN ARTS, HUMANITIES, SOCIAL SCIENCES, ECONOMICS MANAGEMENT, SOCIAL DEVELOPMENT AND ALLIED SCIENCES

ICICET26SP1099T22

A Hybrid and Temporal Approach for Link Prediction in Social Networks Using Structural Similarity Measures

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ABSTRACT
Link prediction is an important problem in social network analysis. It aims to identify possible future connections between users in evolving social networks. Traditional methods such as Jaccard similarity, Adamic-Adar index, and Preferential Attachment mainly depend on network structure. These methods are useful for measuring node similarity, but they do not capture changes in user relationships over time. Social networks change over time. User relationships are not fixed. Link formation depends on both past and recent interactions between users. This study proposes a hybrid link prediction model. The model combines multiple similarity measures with a temporal updating mechanism. It uses both structural and temporal information to capture changes in the network. The model is evaluated on a real-world social network dataset represented in edge-list form. Existing links are treated as positive samples. Randomly selected non-links are treated as negative samples. The performance of the model is measured using AUC (Area Under the Curve), accuracy, precision, recall, and F1-score. The results show that the proposed hybrid model performs better than individual similarity methods. The model produces more accurate link prediction results and improves prediction performance in social networks. The results show that combining similarity measures with temporal information improves link prediction in changing social networks.

Keywords: *Link Prediction, Social Network Analysis, Temporal Networks, Hybrid Model*

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Impact of AI-Driven Core Competencies on Employee Performance: A study in Higher Education Institutions

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ABSTRACT

In the realm of higher education, the use of Artificial Intelligence (AI) is rapidly revolutionizing organizational operations, learning strategies, and job functions. The application of Artificial Intelligence (AI) in higher education is reshaping organizational operations, learning methods, and roles of employees. With the growing integration of AI tools in higher education, staff members need to acquire new skills to leverage these technologies and continue to excel. This study explores how AI can influence core competencies in higher education institutions' employees. The following are some of the core competencies that are essential for AI-driven skills: AI literacy, digital competency, technological adaptability, data-driven decision-making, problem-solving, and continuous learning skills. The study

suggests that those with higher AI capabilities are more likely to quickly adjust to technological shifts, increase productivity, make better decisions, and help achieve organizational goals. The employee's performance is measured on various areas like task performance, productivity, work quality, innovation and goal achievement. The study is quantitative in nature and it involves primary data collection method using a structured questionnaire from the employees of the Higher Education Institutions. The correlation between core competencies achieved by AI and employee performance will be explored using suitable statistical methods. The results will help higher education leaders and HR professionals better understand competencies, competency development, competency training, and workforce transformation with AI. This research adds to the growing body of knowledge in the field of AI and HRM that underscores the role of AI-related skills in achieving sustainable workforce effectiveness in HEIs.

Keywords: *Artificial Intelligence, Employee Performance, Core competencies, Higher Education.*

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