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VOLUME I

NEXTGEN ECI 2026

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SUSTAINABLE DEVELOPMENT GOALS

Department of Electronics and Communication Engineering

School of Engineering

Proceedings of NATIONAL CONFERENCE ON "EMERGING TRENDS IN ELECTRONICS, COMMUNICATION NETWORKS AND EMBEDDED IOT"

NextGen ECI 2026

Industry, Innovation and Infrastructure (SDG 9)

APRIL 8TH 2026

VOLUME-I

Department of Electronics and Communication Engineering
School of Engineering

Proceedings of the National Conference on

"Emerging Trends in Electronics, Communication Networks and Embedded IoT" (NEXTGEN ECI 2026)

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ABOUT THE CONFERENCE

The National Conference on ***"Emerging Trends in Electronics, Communication Networks, and Embedded IoT (NEXTGEN ECI 2026)"*** is organized by the Department of Electronics and Communication Engineering, School of Engineering, Vels Institute of Science, Technology & Advanced Studies (VISTAS).

The conference aims to bring together researchers, academicians, industry experts, and students on a common platform to explore and discuss the latest innovations, trends, and challenges in the fields of electronics, communication networks, and embedded Internet of Things (IoT). With the rapid advancement of technology, these domains are playing a crucial role in shaping smart systems, intelligent communication, and connected environments.

NEXTGEN ECI 2026 provides an excellent opportunity for participants to present their research findings, exchange ideas, and foster collaborations across interdisciplinary domains. The conference features technical paper presentations, keynote sessions by eminent experts, and interactive discussions that encourage knowledge sharing and innovation.

The selected papers included in the proceedings have undergone a rigorous peer-review process to ensure originality, quality, and relevance. The conference is conducted in a hybrid mode, enabling both offline and online participation, thereby ensuring wider accessibility and inclusivity.

This conference is expected to serve as a catalyst for future research, promoting advancements in emerging technologies and contributing to the development of innovative solutions for real-world challenges.

ABOUT THE INSTITUTION

Vels Institute of Science, Technology & Advanced Studies-VISTAS (Deemed-to-be-University) has been backed by 20+ years of academic excellence, offering a learning experience designed to shape industry-ready professionals for global careers. The university follows a semester-based system across all UG and PG programs, giving students greater flexibility and the freedom to personalise their learning journey. All programs are UGC recognized and AICTE approved, ensuring national credibility.

ABOUT THE DEPARTMENT

Established in 2008, the Department of Electronics and Communication Engineering offers programs approved by NBA, UGC, and AICTE. The department focuses on experienced faculty, state-of-the-art laboratories, and strong collaborations with government agencies and industries such as NIOT, IGCAR, and Faurecia. It also actively undertakes sponsored research projects funded by organizations like MOES (Deep Ocean Mission) and TNSCST, fostering advanced laboratories and innovative research initiatives.

VISION OF THE DEPARTMENT

To be a centre of excellence in the field of Electronics and Communication Engineering (ECE) equipped with the state of art technologies to produce highly competent, resourceful, and ethical young professionals who create innovative solutions to the needs of the society and excel in the varied professional trends globally.

MISSION OF THE DEPARTMENT

M1: To impart strong theoretical and experimental fundamentals in electronics and communication engineering that enable students to be competent in the growing technical demands and challenges.

M2: To facilitate appropriate technical exposure on the latest and cutting-edge technological trends through academic and collaborative interactions with industry, academia and research organizations.

M3: To foster an environment of excellence in theoretical and applied research evident through product development, patents, projects, publications in SCI and WOS journals, books and conferences.

M4: To participate in the development of the nation through social and ethical commitments by promising innovation, research and entrepreneurship.

MESSAGE FROM THE CHANCELLOR'S DESK

Dr. ISHARI K. GANESH
Founder- Chancellor

In today's technological era, the role of Electronics and Communication Engineering has become increasingly significant in driving digital transformation and enabling advanced communication systems and embedded technologies that enhance efficiency, sustainability, and quality of life.

The National Conference on ***Emerging Trends in Electronics, Communication Networks, and Embedded IoT (Next-Gen ECI 2026),*** organized by the Department of Electronics and Communication Engineering at VISTAS, serves as a vibrant platform to showcase recent advancements in these domains. The conference will bring together academicians, researchers, industry professionals, and students from across the country to share innovative ideas, exchange knowledge, and explore emerging trends in electronics, communication networks, and embedded IoT.

I firmly believe that the intellectual discussions and collaborative spirit fostered during this conference will lead to meaningful innovations and inspire future research directions and also contribute to the nation's technological growth and global competitiveness.

I extend my heartfelt congratulations to the faculty members, organizing committee, and students of the Department of Electronics and Communication Engineering for their dedicated efforts in organizing this prestigious event. My best wishes for the grand success of Next-Gen ECI 2026.With Best Wishes

With Best Wishes
Dr. Ishari K.Ganesh
Founder & Chancellor, VISTAS

MESSAGE FROM THE PRO-CHANCELLOR'S DESK

Dr. A. Jothi Murugan
Pro-Chancellor (P&D), VISTAS

I am pleased to note that the Department of Electronics and Communication Engineering, VISTAS, is organizing the National Conference on ***"Emerging Trends in Electronics, Communication Networks, and Embedded IoT (NEXTGEN ECI 2026)".*** This conference reflects the institution's continued commitment to fostering innovation, research, and academic collaboration in the fields of engineering and technology.

Electronics and Communication Engineering plays a pivotal role in driving technological advancements and societal development. With the rapid growth of communication networks, embedded systems, and Internet of Things (IoT), these domains are transforming industries and enabling smarter, more connected environments. NEXTGEN ECI 2026 provides an excellent platform for researchers, industry professionals, and students to present their work, exchange ideas, and build meaningful collaborations.

I believe that the deliberations of this conference will lead to new insights, encourage interdisciplinary research, and contribute to technological advancements with real-world impact. I commend the Department of Electronics and Communication Engineering for its dedicated efforts in organizing this significant event.

I extend my best wishes to all participants, speakers, sponsors, and organizers for the grand success of the conference.

With Best Wishes,
Dr. A. Jothi Murugan
Pro-Chancellor (P&D), VISTAS

MESSAGE FROM THE VICE PRESIDENT'S DESK

Dr. Preethaa Ganesh
Vice President, Vels Group of Institutions

I am pleased to note that the Department of Electronics and Communication Engineering, VISTAS, is organizing the National Conference on ***"Emerging Trends in Electronics, Communication Networks, and Embedded IoT (NEXTGEN ECI 2026)"*** at our campus. This conference will provide an excellent platform for bringing together academicians, researchers, industry professionals, and students to share their knowledge, innovations, and experiences.

Electronics and Communication Engineering continue to be a cornerstone of technological advancement. With the rapid evolution of communication networks, embedded systems, and the Internet of Things (IoT), these domains are playing a vital role in driving digital transformation and building smart, connected systems. Conferences such as **NEXTGEN ECI 2026** are instrumental in fostering collaboration and shaping future research directions.

I am confident that the technical sessions, keynote addresses, and discussions will inspire new ideas, promote innovation, and strengthen industry–academia partnerships. I extend my sincere appreciation to the organizing committee, faculty members, and students for their dedicated efforts in making this conference a success.

My best wishes to all participants for a rewarding and enriching conference experience.

Best Regards,
Dr. Preethaa Ganesh
Vice President
Vels Group of Institutions

MESSAGE FROM THE PRO-CHANCELLOR (SOE)

Dr. M. Bhaskaran
Pro-Chancellor (SOE), VISTAS

It gives me immense pleasure to note that the Department of Electronics and Communication Engineering, School of Engineering, Vels Institute of Science, Technology & Advanced Studies (VISTAS) is organizing the National Conference on ***"Emerging Trends in Electronics, Communication Networks, and Embedded IoT (NEXTGEN ECI 2026)".*** The themes and sessions planned for this conference are timely and highly relevant, highlighting the latest innovations and research directions in Electronics and Communication Engineering and its allied domains. With the increasing focus on communication technologies, embedded systems, IoT, smart devices, and digital transformation, this conference provides a vibrant platform for academicians, researchers, industry professionals, and students to share their expertise and insights.

I am pleased to note that eminent experts will deliver keynote addresses and that participants from various institutions will present technical papers. Such interactions will enrich knowledge, promote collaboration, and help address the challenges of modern technology and innovation. I encourage all participants to actively engage in the sessions, keynote lectures, and discussions to gain maximum academic and professional benefit. I am confident that **NEXTGEN ECI 2026** will be a grand success. I congratulate the organizing committee, faculty members, and students for their dedicated efforts in organizing this prestigious event. I extend my best wishes for the success of the conference and for it to set a benchmark for future academic and research initiatives.

With Best Wishes,
Dr. M. Bhaskaran
Pro-Chancellor (SOE), VISTAS

FOREWORD

Dr. T. Sasipraba
Vice-Chancellor, VISTAS

It gives me great pleasure to note that the Department of Electronics and Communication Engineering, School of Engineering, Vels Institute of Science, Technology & Advanced Studies (VISTAS), is organizing the National Conference on ***Emerging Trends in Electronics, Communication Networks, and Embedded IoT*** **(NEXTGEN ECI 2026).**

The conference focuses on contemporary and emerging areas that are shaping the future of engineering and technology. With the increasing importance of communication networks, embedded systems, and IoT-driven applications, such initiatives play a vital role in bridging the gap between academia and industry.

I am delighted that distinguished experts will share their insights through keynote sessions and that participants will present their research contributions. These interactions will undoubtedly inspire innovative thinking, collaborative research, and practical solutions to technological challenges.

I appreciate the efforts of the organizing team in bringing together such a meaningful academic platform. I am confident that this conference will achieve its objectives and set a benchmark for future events.

Best Regards
Dr. T. Sasipraba
Vice-Chancellor, VISTAS

MESSAGE

Dr. M. Chandrasekaran
Registrar, VISTAS

It is a matter of great pride to note that the Department of Electronics and Communication Engineering, School of Engineering, Vels Institute of Science, Technology & Advanced Studies (VISTAS), is organizing the National Conference on ***Emerging Trends in Electronics, Communication Networks, and Embedded IoT*** **(NEXTGEN ECI 2026).**

The conference provides an excellent opportunity for participants to exchange ideas, present research findings, and explore advancements in the fields of electronics, communication, and embedded technologies. The chosen themes reflect the current trends and future directions of engineering innovation.

I am glad that the conference is being hosted with keynote speakers and technical sessions involving participants from diverse backgrounds. Such academic engagements play a crucial role in enhancing knowledge, encouraging innovation, and promoting collaborative research.

I extend my sincere appreciation to the organizing committee, faculty members, and students for their commitment and efforts towards this conference. I wish the conference a grand success and hope it paves the way for future academic excellence.

Best Regards,
Dr. M. Chandrasekaran
Registrar, VISTAS

MESSAGE

Dr. C. Arun
Dean – School of Engineering
VISTAS

It gives me immense pleasure to note that the Department of Electronics and Communication Engineering, School of Engineering, Vels Institute of Science, Technology & Advanced Studies (VISTAS), is organizing the National Conference on ***Emerging Trends in Electronics, Communication Networks, and Embedded IoT*** **(NEXTGEN ECI 2026).**

The themes and sessions planned for this conference are timely and highly relevant, highlighting the latest innovations and research directions in Electronics, Communication Engineering, and Embedded IoT domains. In an era driven by rapid technological advancements, including smart systems, connected devices, and intelligent communication networks, this conference provides a vibrant platform for academicians, researchers, industry professionals, and students to share their expertise and ideas.

I am pleased to note that eminent scholars and experts will deliver keynote addresses and that participants from various institutions will present technical papers. Such interactions will enhance knowledge sharing and foster collaborations to address real-world engineering challenges.

I am confident that ***NEXTGEN ECI 2026*** will be a grand success and will significantly contribute to advancing research and innovation. I sincerely congratulate the organizing committee, faculty members, and students for their dedicated efforts in organizing this prestigious event.

With Best Wishes,
Dr. C. Arun
Dean – School of Engineering, VISTAS

MESSAGE

Dr. V. Rajendran'

Distinguished Professor – Research

VISTAS

It gives me immense pleasure to extend my warm greetings to all participants of the National Conference on ***"Emerging Trends in Electronics, Communication Networks, and Embedded IoT (NEXTGEN ECI 2026)"*** organized by the Department of Electronics and Communication Engineering, School of Engineering, VISTAS.

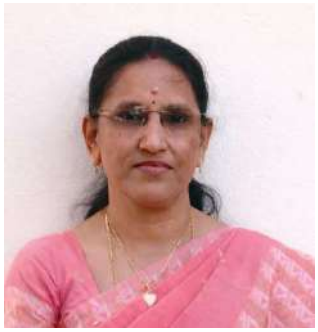
In today's rapidly evolving technological landscape, advancements in electronics, communication systems, and embedded IoT are playing a transformative role in shaping innovative solutions for real-world challenges. This conference serves as an excellent platform for researchers, academicians, industry professionals, and students to share their knowledge, exchange ideas, and explore emerging research directions.

I commend the organizers for their dedicated efforts in bringing together experts and scholars from diverse domains to foster collaboration and promote research excellence. I am confident that the deliberations and discussions during this conference will contribute significantly to technological advancements and inspire future innovations.

I extend my best wishes for the grand success of the conference and hope that it will provide valuable insights and fruitful outcomes for all participants.

Best Regards,
Dr. V. Rajendran
Distinguished Professor – Research, VISTAS

HoD's DESK



Dr. A.Vijayalakshmi
Professor & HOD/ECE

It is a great pride and honor to be associated with the National Conference **NEXTGEN ECI 2026** on ***"Emerging Trends in Electronics, Communication Networks, and Embedded IoT***," organized by the Department of Electronics and Communication Engineering, School of Engineering, VISTAS. The rapid advancements in electronics, communication technologies, and embedded IoT systems are transforming industries and redefining modern society. This conference serves as a significant platform for researchers, academicians, industry experts, and students to share their insights, present innovative research, and discuss emerging challenges and opportunities in these dynamic fields. The contributions included in this volume have been carefully reviewed and selected for their quality, originality, and relevance. They reflect the latest developments and forward-thinking approaches that will shape the future of technology and engineering.

Our department is privileged to have an esteemed Chief Guest whose presence and insights have greatly enriched the conference. We would also like to express our gratitude to the Session Chairs for their effective moderation, insightful observations, and for ensuring the smooth conduct of the technical sessions.

I extend my sincere appreciation to the authors for their valuable contributions, the reviewers for their meticulous evaluation, and the organizing committee for their dedicated efforts in successfully conducting this conference. It is my earnest hope that this proceeding will serve as a valuable reference for researchers and practitioners, and will inspire continued innovation and excellence in the field of Electronics and Communication Engineering. With best wishes for continued success and academic excellence.

Best Wishes,
Dr. A. Vijayalakshmi
HOD/ECE, VISTAS

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INNOVATIVE SOLUTION

We sincerely thank **Innovative Solution**, established in 2008, for their valuable support as a sponsor. As a distinguished service provider and distributor of advanced test and measurement instruments from DEWESoft, they have been consistently contributing to the growth of the Aerospace, Defence, and Automotive industries in India. Driven by a strong vision to be at the forefront of India's industrial development, their commitment to innovation and excellence is truly commendable. We deeply appreciate their generous support and partnership in making this event a success.

PREFACE

Welcome to the proceedings of the National Conference on ***"Emerging Trends in Electronics, Communication Networks, and Embedded IoT (NEXTGEN ECI 2026)"*,** organized by the Department of Electronics and Communication Engineering, VISTAS. This publication presents a collection of innovative research papers, insightful discussions, and emerging developments showcased during the conference.

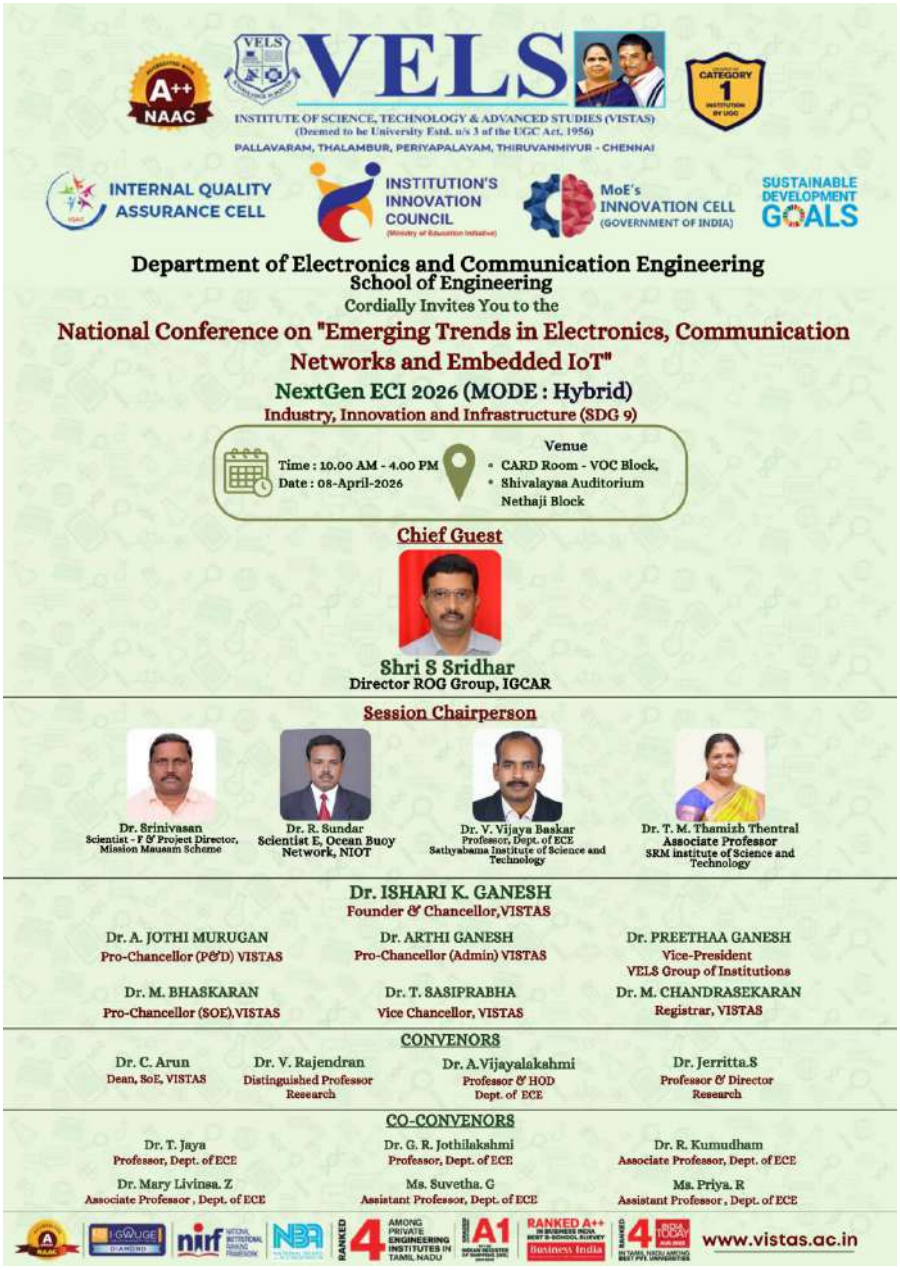
The theme of the conference reflects our commitment to advancing the fields of electronics, communication, and embedded IoT technologies while addressing real-world challenges through intelligent and connected solutions. The technical tracks cover a wide range of areas including communication networks, embedded systems, Internet of Things (IoT), signal processing, and smart technologies, highlighting the interdisciplinary nature of modern engineering research.

All papers included in these proceedings have undergone a rigorous peer-review process by experts to ensure quality, originality, and relevance. The selected contributions demonstrate significant advancements that not only enrich academic research but also provide practical insights for industry and societal applications.

The conference brings together academicians, researchers, industry professionals, and students from various institutions, fostering collaboration and knowledge exchange. It serves as a platform to bridge the gap between academia and industry, encouraging innovative ideas and future research directions.

We extend our sincere gratitude to all authors, reviewers, keynote speakers, and organizers for their valuable contributions and support in making this conference a success.

We hope that these proceedings will serve as a valuable reference and inspire continued research, innovation, and collaboration in the ever-evolving domains of electronics, communication, and IoT.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National Conference on "Emerging Trends in Electronics, Communication Networks and Embedded IoT"
NextGen ECI 2026 (MODE : Hybrid)
Industry, Innovation and Infrastructure (SDG 9)
Time : 10.00 AM - 4.00 PM
Date : 08-April-2026
Venue
• CARD Room - VOC Block,
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Nethaji Block
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Scientist - F & Project Director, Mission Mausam Scheme
Dr. R. Sundar
Scientist E, Ocean Buoy Network, NIOT
Dr. V. Vijaya Baskar
Professor, Dept. of ECE
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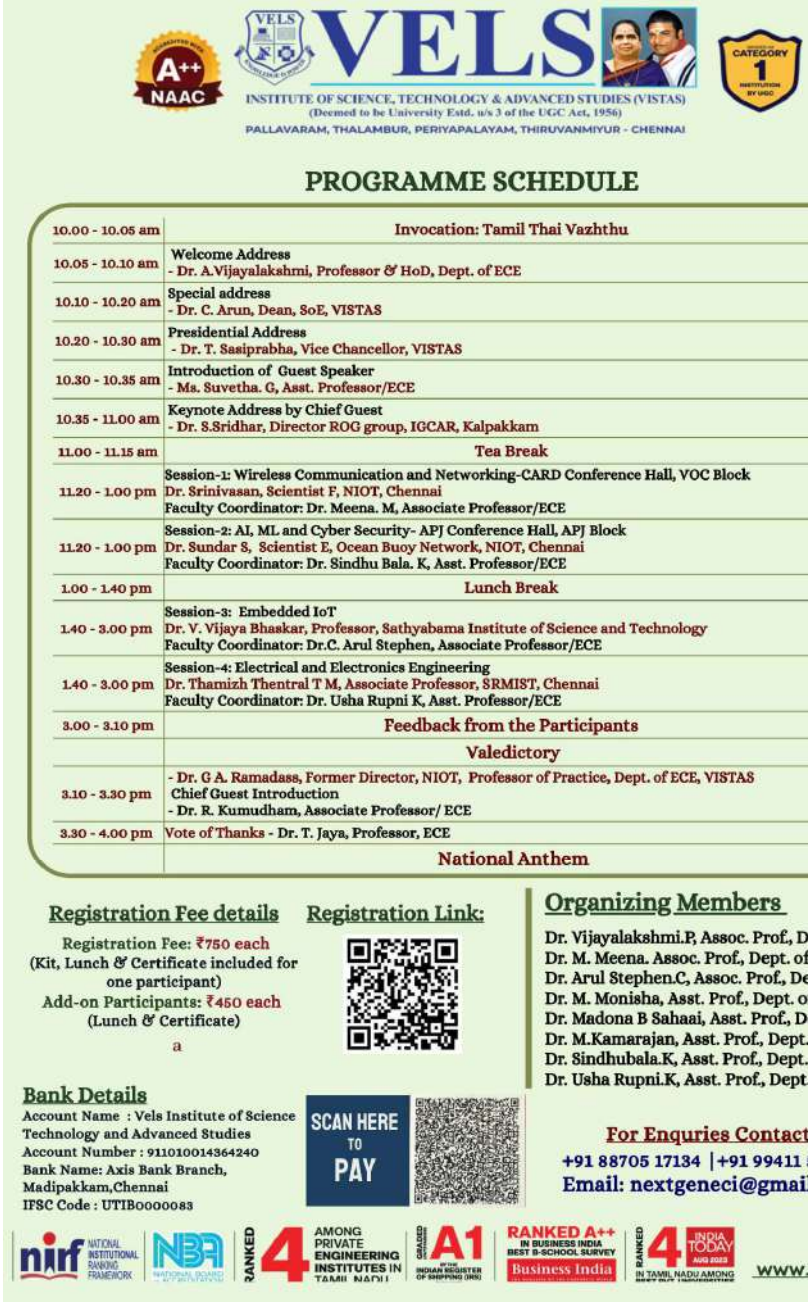
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A++ NAAC
CATEGORY 1
PROGRAMME SCHEDULE
10.00 - 10.05 am | Invocation: Tamil Thai Vazhthu
10.05 - 10.10 am | Welcome Address - Dr. A.Vijayalakshmi, Professor & HoD, Dept. of ECE
10.10 - 10.20 am | Special address - Dr. C. Arun, Dean, SoE, VISTAS
10.20 - 10.30 am | Presidential Address - Dr. T. Sasiprabha, Vice Chancellor, VISTAS
10.30 - 10.35 am | Introduction of Guest Speaker - Ms. Suvetha. G, Asst. Professor/ECE
10.35 - 11.00 am | Keynote Address by Chief Guest - Dr. S.Sridhar, Director ROG group, IGCAR, Kalpakkam
11.00 - 11.15 am | Tea Break
11.20 - 1.00 pm | Session-1: Wireless Communication and Networking-CARD Conference Hall, VOC Block
Dr. Srinivasan, Scientist F, NIOT, Chennai
Faculty Coordinator: Dr. Meena. M, Associate Professor/ECE
11.20 - 1.00 pm | Session-2: AI, ML and Cyber Security- APJ Conference Hall, APJ Block
Dr. Sundar S, Scientist E, Ocean Buoy Network, NIOT, Chennai
Faculty Coordinator: Dr. Sindhu Bala. K, Asst. Professor/ECE
1.00 - 1.40 pm | Lunch Break
1.40 - 3.00 pm | Session-3: Embedded IoT
Dr. V. Vijaya Bhaskar, Professor, Sathyabama Institute of Science and Technology
Faculty Coordinator: Dr.C. Arul Stephen, Associate Professor/ECE
1.40 - 3.00 pm | Session-4: Electrical and Electronics Engineering
Dr. Thamizh Thentral T M, Associate Professor, SRMIST, Chennai
Faculty Coordinator: Dr. Usha Rupni K, Asst. Professor/ECE
3.00 - 3.10 pm | Feedback from the Participants
Valedictory
3.10 - 3.30 pm | - Dr. G A. Ramadass, Former Director, NIOT, Professor of Practice, Dept. of ECE, VISTAS
Chief Guest Introduction
- Dr. R. Kumudham, Associate Professor/ ECE
3.30 - 4.00 pm | Vote of Thanks - Dr. T. Jaya, Professor, ECE
National Anthem
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(Kit, Lunch & Certificate included for one participant)
Add-on Participants: ₹450 each
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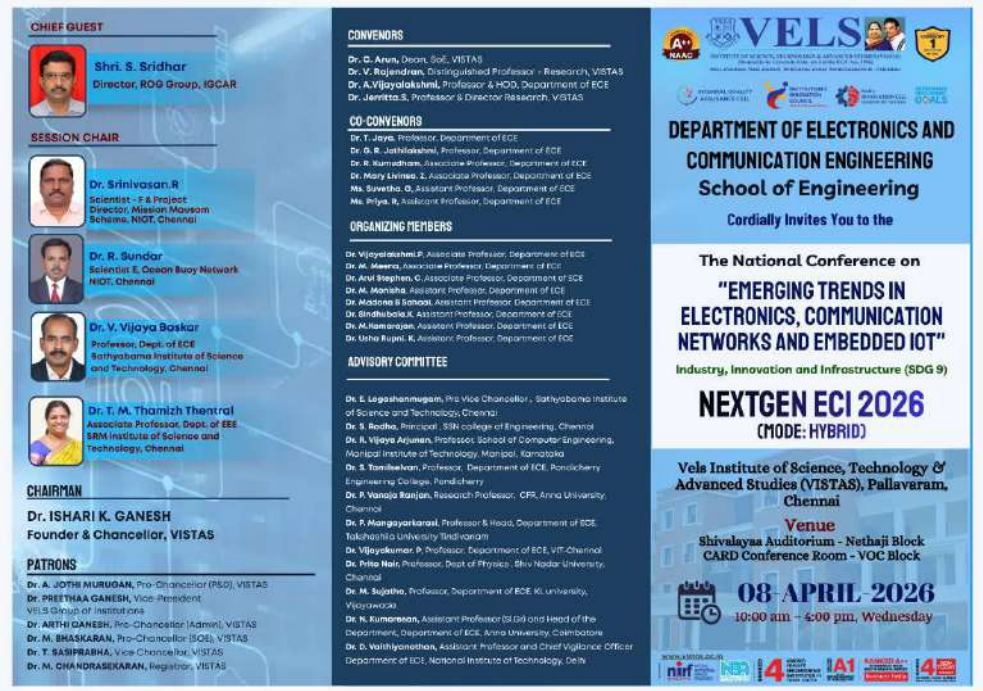
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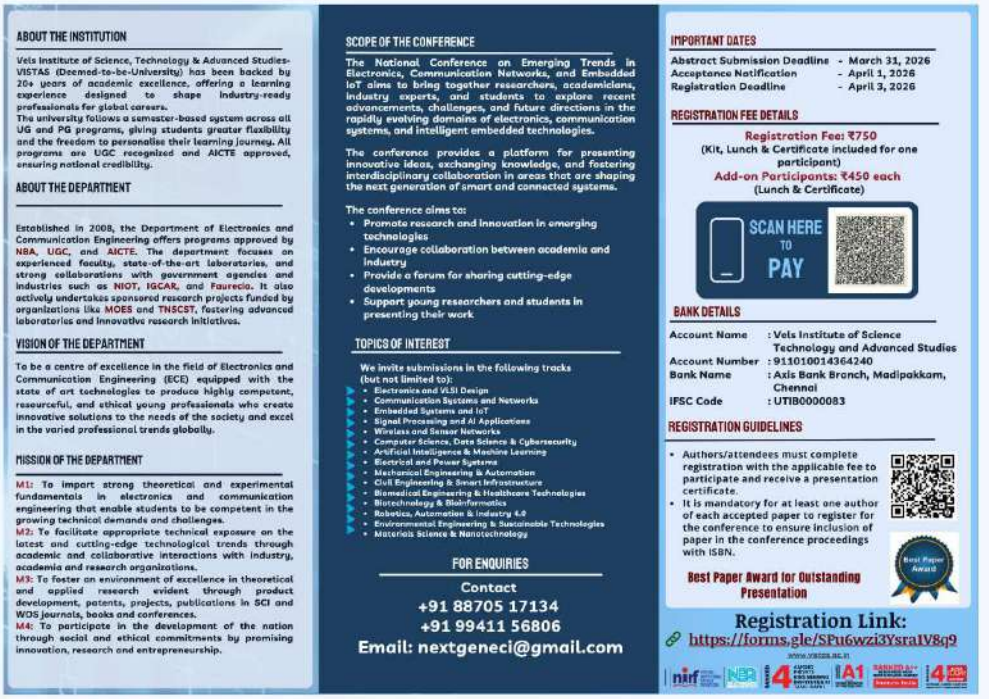
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Vels Institute of Science, Technology & Advanced Studies-VISTAS (Deemed-to-be-University) has been backed by 20+ years of academic excellence, offering a learning experience designed to shape industry-ready professionals for global careers.
The university follows a semester-based system across all UG and PG programs, giving students greater flexibility and the freedom to personalise their learning journey. All programs are UGC recognized and AICTE approved, ensuring national credibility.
ABOUT THE DEPARTMENT
Established in 2008, the Department of Electronics and Communication Engineering offers programs approved by NBA, UGC, and AICTE. The department focuses on experienced faculty, state-of-the-art laboratories, and strong collaborations with government agencies and industries such as NIOT, IGCAR, and Faurecia. It also actively undertakes sponsored research projects funded by organizations like MOES and TNSCST, fostering advanced laboratories and innovative research initiatives.
VISION OF THE DEPARTMENT
To be a centre of excellence in the field of Electronics and Communication Engineering (ECE) equipped with the state of art technologies to produce highly competent, resourceful, and ethical young professionals who create innovative solutions to the needs of the society and excel in the varied professional trends globally.
MISSION OF THE DEPARTMENT
M1: To impart strong theoretical and experimental fundamentals in electronics and communication engineering that enable students to be competent in the growing technical demands and challenges.
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M3: To foster an environment of excellence in theoretical and applied research evident through product development, patents, projects, publications in SCI and WOS journals, books and conferences.
M4: To participate in the development of the nation through social and ethical commitments by promising innovation, research and entrepreneurship.
SCOPE OF THE CONFERENCE
The National Conference on Emerging Trends in Electronics, Communication Networks, and Embedded IoT aims to bring together researchers, academicians, industry experts, and students to explore recent advancements, challenges, and future directions in the rapidly evolving domains of electronics, communication systems, and intelligent embedded technologies.
The conference provides a platform for presenting innovative ideas, exchanging knowledge, and fostering interdisciplinary collaboration in areas that are shaping the next generation of smart and connected systems.
The conference aims to:
• Promote research and innovation in emerging technologies
• Encourage collaboration between academia and industry
• Provide a forum for sharing cutting-edge developments
• Support young researchers and students in presenting their work
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• Embedded Systems and IoT
• Signal Processing and AI Applications
• Wireless and Sensor Networks
• Computer Science, Data Science & Cybersecurity
• Artificial Intelligence & Machine Learning
• Electrical and Power Systems
• Mechanical Engineering & Automation
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• Robotics, Automation & Industry 4.0
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OFDM Autoencoder with Deep Learning Integration for Embedded Communication Systems

Rajarajan Paneerselvam[1] and Madona B Sahaai[2]

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ABSTRACT

Orthogonal Frequency Division Multiplexing (OFDM) is a widely adopted modulation technique in modern wireless communication systems due to its high spectral efficiency and robustness against multipath fading. However, conventional OFDM transceivers rely on analytically designed signal processing blocks that require accurate channel estimation and may experience performance degradation in embedded environment is characterized by hardware constraints and dynamic channel conditions. Recent advances in machine learning enable data driven optimization of communication systems using end to end learning approaches such as auto encoders. This paper presents a hybrid OFDM autoencoder architecture with machine learning integration tailored for embedded communication systems. The proposed approach combines neural network based encoding and decoding with conventional FFT based OFDM processing, preserving system compatibility while enhancing robustness. Simulation results over additive white Gaussian noise (AWGN) and Rayleigh fading channels demonstrate improved bit error rate (BER) performance compared to conventional OFDM systems, with moderate computational complexity suitable for embedded implementations.

Keywords- OFDM, Autoencoder, Machine Learning, Embedded Communication Systems, Deep Learning, Wireless Communication.

CLUCKBOT: Intelligent Feeding and Health Tracker for Poultry Farms

Kevin Paul M[1] , DR.G.Merlin Sheeba[2]
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[2] Professor, Jerusalem college of engineering, Pallikaranai, Chennai
[1]kevinpaul.ec2022@jerusalemengg.ac.in

ABSTRACT

With the increasing demands of modern lifestyles, poultry owners often find it challenging to maintain consistent feeding schedules and monitor the health of their poultrys. This project presents the design and development of an Automatic Poultry Feeder and Health Monitoring System using the ESP32/ESP8266 microcontroller. The system aims to automate poultry feeding at scheduled intervals and simultaneously monitor environmental and behavioral parameters to ensure poultry well-being.The feeder is controlled by a servo motor that dispenses a pre-defined amount of food at scheduled times. A real-time clock (RTC) module or time- based logic in the microcontroller ensures accurate scheduling. The load cell with HX711 amplifier measures the food consumption by weighing the bowl before and after feeding, helping monitor the poultry's eating habits. An ultrasonic sensor checks the food level in the storage container to notify the owner when a refill is needed.For health monitoring, a combination of sensors such as a DHT11/22 (for ambient temperature and humidity) and PIR or IR motion sensors (for activity detection) is used. These provide insights into the poultry's environment and behavior. The ESP module sends real-time data to a cloud platform (like Blynk, Firebase, or MQTT) or a mobile app, enabling remote monitoring and control.The system not only ensures timely feeding but also promotes better poultry care through data-driven insights. This project can be extended with features like camera monitoring, water dispensing, or AI-based health prediction, making it a scalable and practical solution for modern poultry management.

Keywords: ESP32 / ESP8266, Blynk / Firebase / MQTT, Cloud Integration, Ultrasonic Sensor

IOT Based Automatic Engine Locking Based on Alcohol Detection

Attela Karthik [1]

[1] UG Scholar, Sri Mittapalli College of Engineering, Tummalapalem, Guntur, Andhra Pradesh, India
[1]attelakarthik58@gmail.com

ABSTRACT

This project presents an IoT-based automatic engine locking system designed to prevent drunk driving and improve road safety. The system uses an MQ-3 alcohol sensor to detect alcohol levels in the driver's breath and a microcontroller to process the data based on a predefined threshold. If the detected alcohol level exceeds the permissible limit, the system activates a relay mechanism to lock the vehicle engine, preventing ignition. Additionally, a buzzer and LED provide immediate alerts. The integration of NodeMCU (ESP8266) enables IoT functionality for real-time monitoring. A GPS module tracks the vehicle location, and GSM communication sends alerts to registered contacts. The system is cost-effective, reliable, and easy to integrate into existing vehicles. It ensures real-time preventive action, reduces alcohol-related accidents, and promotes responsible driving behavior.

Keywords - IoT, Alcohol Detection, Engine Locking System, MQ-3 Sensor, NodeMCU ESP8266, GPS Tracking, Road Safety, Embedded Systems

LightHub XAI: An Explainable Real-Time Phishing Detection Framework Using Machine Learning

Ms. Nidha Ibrahim[1] and Ms. Sharanya VP[2]

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[2] Assistant Professor Department of Computer Science, Providence Women's College(Autonomous), Calicut
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ABSTRACT

Phishing websites are a major cybersecurity threat because they imitate legitimate websites to steal sensitive information. Against newer phishing websites/zero day attacks the traditional detection methods like whitelist and blacklist systems are ineffective. This project introduces an explainable AI and machine learning structure for phishing detection. The models like Decision Tree, Logistic Regression, and Random Forest models are trained on extracted features based on URL, such as URL length, digit count, suspicious keywords, and flagged domains. The Random Forest Model had the best results. It gave an accuracy of 95.36%,a precision value of 0.96, a recall value of 0.93, and an F1-score of 0.95. Transparency is enhanced while important phishing indicators are outlined using SHAP analysis. The proposed approach gives an accurate, lightweight, and direct approach to phishing detection.

Keywords: Phishing Detection, Machine Learning, Explainable AI, Random Forest, SHAP, Cybersecurity

AI-Driven Multimodal Diagnostic System for Rare Diseases: A Unified Framework for Precision Medicine

Nirmal S [1], Krishnamoorthi R[1] , Mariganesh E[1], Dr. Uma S[2]

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[2] HOD, Computer Science and Engineering, Rajalakshmi Institute of Technology, Chennai
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ABSTRACT:

Currently, the diagnostics of rare diseases remain a challenge in medical settings. The main problem is that there is a lack of adequate and trustworthy datasets, whereas symptoms tend to overlap. Furthermore, there is a small pool of professionals able to identify a rare disease. Due to this fact, patients end up in frustrating diagnostic processes until proper treatment is established. In this paper, we try to come up with a concrete solution-an AI-assisted diagnostic system. Its main fundamentals rely on machine learning algorithms trained by different sources, namely: genetic data, patient information, and medical images. We merge these sources to help in catching all the minute details that a physician or traditional approaches might miss. We have also added an extra layer of effort to this project by incorporating natural language processing elements. This feature will enable our system to stay updated with current breakthroughs in research papers or even medical reports. With that in mind, we hope this project will be able to serve as a stepping stone in ensuring that rare diseases receive a fair diagnosis.

Keywords: Multimodal Learning, Precision Medicine, Rare Diseases, Genomics, NLP

Formulation of Herbal Patch for Dermatitis and Wound Healing Using Leucas Aspera And Tridax Procumbens

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ABSTRACT

The development of herbal patch for the treatment of dermatitis and wound The skin is the largest organ in the body and the most common skin diseases observed are dermatitis and wound. In fact, it needs to be treated to avoid the infection so that it can heals faster. The use of herbal medicine as an alternative to synthetic drugs is due to safety and with least side effect. This study aims to develop a product known as herbal patch that has effective medicinal plant extract that aid in treating dermatitis and aids in faster wound healing.Leucas aspera and Tridax procumbens are plants used in traditional medicine to treat infections and for wound healing. Their leaves are therefore the samples used in the present study. Leaves were harvested, washed, dried, and ground in to fine powder and used as starting material for extraction. The extracts obtained were loaded in to gelatin based polymer matrix to prepare an herbal patch. The physical properties of patches like thickness, elasticity and sturdiness were evaluated. Qualitative phytochemical analysis of the plants were done to assess the secondary metabolites like flavonoids, tannins, alkaloids and terpenoids responsible for antimicrobial and wound healing properties.The antimicrobial activity of the herbal extract was evaluated by using agar well diffusion method on a selected panel of microorganisms. Results showed that the extract exhibited remarkable antimicrobial activity. Thus, the formulated herbal patch could serve as a useful tool for the prevention of microbial infection in the skin, and may be used as a natural and easy method in the treatment of dermatitis and wound healing.

Keywords- Herbal Patch, Dermatitis, Wound Healing, Leucas aspera, Tridax procumbens, Antimicrobial Activity

Performance of Absolute Valued Message Passing Detector for Spectrum Sensing in Cognitive Radio Networks

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ABSTRACT

Cognitive Radio Network (CRN) represents an innovative advancement aimed at enhancing efficiency of spectrum usage, here the Secondary Users (SUs) transmit on licensed spectrum segments when the licensed Primary User (PU) is not actively engaged in its use. Nevertheless, PU chooses to reoccupy the spectrum, the cognitive radio must give it up. By making use of the untapped spectrum areas, a CRN improves the effectiveness of spectrum utilisation. In high-mobility wireless situations, Orthogonal Time-Frequency Space (OTFS) modulation is superior in performance compared to Orthogonal Frequency Division Multiplexing (OFDM). OTFS exhibits notable performance advantages compared to Doppler in scenarios characterized by high mobility. For spectrum sensing in CRN, this article proposes a novel Absolute Valued Message Passing (AVMP) Detector of OTFS under Laplacian noise. In the AVMP detection method, the mean and variance of the interference components act as signals relayed to variable nodes from the observation nodes. We adjust our selection of the transmitted symbols solely when the present iteration produces improved estimates compared to previous iterations. Proposed AVMP detector demonstrates superior performance compared to existing leading detectors while estimating the probability of detection.

Keywords: Orthogonal Time Frequency Space Modulation, Cognitive Radio Network, Absolute Valued Message Passing Detector, Spectrum Sensing, Probability of Detection, Laplacian Noise.

Enhanced Cluster Head Selection Based Resource Allocation with Hybrid PSO and Modified Moth Flame Optimization in Cognitive Radio Networks for IoT Applications

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ABSTRACT

ECHRAC employs a dual-phase approach that efficiently selects the cluster head (CH) and uses specialized algorithms in conjunction with inverse optimization methods. Spectrum sensing plays a crucial role in the selection of CH. Using primary user (PU) channels by clusters of secondary users will enhance spectrum access and decrease interference during this phase. ECHRAC employs a delicate approach to the probabilistic framework that manages false alarms, setting up high detection thresholds in such synchronization to prevent interference with PU. The ECHRACs cluster formation and path selection phase is given significant attention. Nodes in the CRN are dynamically clustered according to the availability of the spectrum and their proximity to nodes. A complex selection procedure is involved in this stage, which identifies nodes with optimal energy and connectivity attributes for CH roles. ECHRAC employs a unique energy state function that utilizes Energy Harvesting (EH) to

determine the clusters CH status. By selecting CHs through a competitive process, nodes that meet these energy requirements are selected to maintain varying amounts of energy across the network. ECHRAC employs an energy-based control system that divides nodes into active, sleep and dead states based on their remaining energy to improve the reliability of data transmission. This mechanism minimizes energy depletion risk, which permits nodes in low-power states to prioritize crucial tasks or switch to sleep mode to conserve energy. A hybrid approach is employed during the optimization phase, which involves combining an Improved Particle Swarm Optimization (PSO) algorithm with the Modified Moth Flame Optimization (MFO) Algorithm. ECHRACs PSO algorithm utilizes a particle-based representation scheme to represent potential solutions, while also considering the optimization of node parameters for efficient clustering and route selection. By using a logarithmic spiral function, the MFO algorithm dynamically alters the paths of CH nodes to achieve optimal convergence towards high-fitness node convection, while minimizing the need for flames in each iteration. By utilizing dual optimization techniques, network longevity, and throughput are improved, and data transmission reliability is enhanced by prioritizing routes with energy-efficient CH nodes. Simulation results show that ECHRAC has a significant impact on several performance metrics of CRN. This model is implemented using MATLAB software, focusing on parameters such as network throughput, power usage, energy efficiency, data delivery ratio, and average delay for performance analysis.

Keywords: Cognitive radio network (CRN), cluster head (CH), primary user (PU), Energy Harvesting (EH), Modified Moth Flame Optimization (MFO), Particle Swarm Optimization (PSO), Enhanced CH Selection, Resource Allocation, and Hybrid Optimization Process.

Speed control of a DC motor using Controllers

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ABSTRACT

This paper describes the speed control of a DC shunt motor using conventional controllers (PID, IMC) controller based on LabVIEW Simulation program. A mathematical model of the process has been developed using real plant data and then conventional controllers and Fuzzy logic controller has been designed. A comparative analysis of performance evaluation of all controllers has been done.

Keywords- PID Controller, IMC, DCMotor

Smart TPOT based AutoML-Powered Android Malware Detection and Classification

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ABSTRACT

Systems and networks can be seriously threatened by malware, often known as malicious software. The sophistication of malware assaults is increasing, making it harder to identify and stop them. For a number of reasons, including the protection of private data, data loss and alteration, system interruptions, monetary losses, and reputational harm, malware detection and prevention are essential. Various machine learning models such as Random Forest, Support Vector Machine, K- NN, Extra tree classifier, Gradient Boosting and AdaBoost is applied for Android malware detection is presented in this research.A Python-based machine learning tool called Python Optimised ML Pipeline (TPOT) uses genetic programming to maximize network throughput. To retrieve static information like permissions, network calls, API calls, and system traffic from the malicious apps for Android dataset,
we employ TPOT constructs models.Moreover, comparison has made with traditional Machine learning classifiers and Automated ML for greater performance by reduction in computational time, training speed, and efficiency. Subsequently, metrics such as precision, F1- score, Recall and accuracy for evaluating overall performance of models. The analysis proved that Automated ML provides better outcomes of 99.7% accuracy with lesser computational complexity and reduction in training time.

Keywords- Automated Machine Learning (AutoML), Tree based Pipeline Optimization Tool (TPOT), Gradient Boosting, ExtraTree, and AdaBoost.

Single Image Rain Removal Using Bilateral Filtering and U-Net Based Generative Adversarial Network with PatchGAN Discriminator

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ABSTRACT

Rain streaks in outdoor images significantly reduce visual quality and can negatively affect the performance of many computer vision systems. Applications such as autonomous driving, surveillance, traffic monitoring, and remote sensing rely on clear images to accurately interpret visual scenes. However, images captured during rainy conditions often contain streak-like artifacts that obscure important details such as edges, textures, and objects. To address this problem, this paper proposes a deep learning–based image de-raining approach using a Generative Adversarial Network (GAN). The proposed framework employs a U-Net based generator to learn the mapping between rainy images and their corresponding clean images. To improve the realism of the generated outputs, a PatchGAN discriminator is used to evaluate local image regions and enforce texture consistency. In addition, bilateral filtering is applied during preprocessing to reduce rain noise while preserving important structural information in the image. The model is trained using a combination of reconstruction loss, adversarial loss, and total variation loss to ensure effective rain removal and stable image reconstruction. An additional output enhancement stage consisting of contrast enhancement, sharpening, and noise reduction filters is applied to further improve the visual clarity of the reconstructed images. Experimental results evaluated using Peak Signal-to-Noise Ratio (PSNR) and Structural Similarity Index Measure (SSIM) show that the proposed method effectively removes rain streaks while preserving fine image details. The developed approach can be applied to enhance images captured in rainy environments and improve the reliability of outdoor vision systems.

IoT-Based Satellite Antenna Monitoring, Positioning and Control System

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ABSTRACT

This project presents an IoT-Based Smart Satellite Antenna Monitoring, Positioning and Control System for intelligent antenna alignment and remote supervision. The system performs 2D global scanning to detect the optimal signal direction and applies an auto signal locking algorithm for precise antenna positioning. IMU-based tilt sensing is used to detect uneven or abnormal ground surfaces and perform level correction to improve alignment accuracy. Environmental sensors provide awareness of weather conditions for reliable operation. IoT connectivity enables real-time monitoring, control, and visualization through a mobile or web dashboard. The proposed system reduces manual effort, improves positioning precision, and enhances operational reliability, making it suitable for smart satellite communication, educational demonstrations, and automated antenna control applications.

Keywords: IoT, Satellite Antenna, 2D Global Scan, Auto Signal Locking, IMU Tilt Compensation, Environmental Awareness, Smart Tracking, Automation.

High-Performance VLSI Addition: Low-Power Kogge-Stone Carry Select Adder

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ABSTRACT

Adders are fundamental components in digital systems and play a crucial role in determining the overall performance of arithmetic units in VLSI design. Conventional adders, such as Ripple Carry Adders (RCA) and Carry Look-Ahead Adders (CLA), involve inherent trade-offs between speed, area, and power consumption. This paper presents an optimized Carry Select Adder (CSLA) architecture by integrating the Kogge- Stone Adder (KSA), a parallel prefix structure well-known for its high-speed performance. In the proposed design, traditional RCAs within the CSLA are replaced with KSA blocks to significantly reduce propagation delay while improving area efficiency. Simulation results demonstrate that the proposed KSA-based CSLA achieves superior performance compared to conventional CSLA designs in terms of speed, power consumption, and area-delay product. Therefore, the proposed architecture is highly suitable for high-performance VLSI applications, including processors and digital signal processing systems.

Keywords- VLSI, Carry Select Adder, Kogge-Stone Adder, Parallel Prefix, Low Power, High Speed, Area Efficiency

Design and Analysis of a 6 th Order Interdigital Bandpass Filter Using HFSS for Microwave Applications

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ABSTRACT

This paper presents the design and analysis of a 6th order interdigital bandpass filter using High Frequency Structure Simulator (HFSS) for microwave frequency applications. The proposed filter is based on a Chebyshev Type-I response, designed to achieve a center frequency of 1 GHz with a passband bandwidth of 200 MHz and a ripple of 0.05 dB. The interdigital configuration employs parallel coupled microstrip resonators, which provide a compact structure and improved coupling control compared to conventional filter topologies. The design process begins with the synthesis of low-pass prototype parameters, followed by their transformation into bandpass specifications. Physical dimensions such as resonator lengths, widths, spacing (gaps), and tap positions are calculated and optimized to meet the required electrical performance. The filter is implemented on a dielectric substrate with appropriate material properties to ensure minimal losses and stable operation. Simulation results obtained from HFSS demonstrate that the designed filter achieves desirable performance characteristics, including low insertion loss within the passband and high attenuation in the stopband regions. The S-parameter analysis confirms sharp selectivity and effective suppression of unwanted frequencies. Additionally, the group delay response indicates minimal signal distortion across the passband, making the filter suitable for high-frequency communication systems. The interdigital structure offers advantages such as reduced size, ease of fabrication, and better control over coupling between resonators. The close agreement between theoretical design and simulated results validates the accuracy of the design methodology. This work highlights the effectiveness of HFSS as a powerful tool for modelling and optimizing microwave filters. Overall, the proposed interdigital bandpass filter is well- suited for applications in wireless communication systems, radar systems, and other microwave signal processing domains where compact size and high performance are essential.

Marine Debris detection using Side Scan Sonar Images

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ABSTRACT

Marine debris is one of the most serious environmental challenges of current times, posing threats to human health, the environment and marine ecosystems. Due to the nature of the work, aquatic waste monitoring is time-consuming, labour-intensive and lacks efficacy when performed manually. This study implements an automated deep learning-based approach for the detection of aquatic marine debris by using the YOLOv8 object detection framework. A publicly available marine debris dataset comprised of 1,868 annotated aquatic photographs divided into 11 distinct object classes, including bottles, barrels, tyres, and plastic containers, was used for training and evaluating the model. The proposed solution uses an ultra-lightweight YOLOv8n model to make efficient detections of debris on hardware with constrained resources. Mean average precision (mAP), precision, and recall metrics were used to evaluate the model, which was trained by employing transfer learning methods. The experimental results indicate that the model has strong detection capabilities and accurate localizations over multiple types of marine debris. The developed system provides an effective, scalable, and real-time method for monitoring aquatic debris, thereby supporting efforts in environmental monitoring, marine conservation, and autonomous robotic removal systems. The study indicates that deep learning-based object detection models can significantly improve the efficiency and accuracy of marine pollutant detection when compared to traditional manual survey methods.

Design And Implementation Of Smart Shopping Cart With Real-Time Payment and E-Receipt Generation

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ABSTRACT

The increasing demand for automation in retail environments has highlighted the need for intelligent shopping solutions that can reduce checkout delays, improve billing accuracy, and enhance customer experience. Conventional shopping systems rely on manual barcode scanning at centralized billing counters, leading to long queues, increased waiting time, and operational inefficiencies. To overcome these limitations, this project presents the design and development of an IoT-based Smart shopping cart system for modern retail applications. The proposed system integrates a barcode scanning module for automatic product identification and a load cell with an HX711 amplifier for real-time weight measurement and theft control. Any mismatch between scanned items and weight variations is detected to prevent unauthorized item removal or addition. An ESP32-S3 microcontroller serves as the core processing unit, handling data acquisition, billing logic, and system control. A 7-inch capacitive touch display acts as the central human–machine interface, providing real-time product details, cart summary, and total billing information to the user. The smart trolley supports dynamic QR code generation for real-time digital payment, allowing customers to complete transactions directly at the cart. Upon successful payment, an electronic receipt (e-receipt) is generated and displayed or transmitted digitally, eliminating the need for printed bills. Additionally, the system includes a product navigation feature that assists users in locating items efficiently within the store, improving overall shopping convenience. The modular and scalable design enables seamless integration with wireless communication and cloud-based services for future expansion. By shifting billing, payment, and verification processes to the trolley level, the proposed system reduces dependency on checkout counters, improves shopping efficiency, and offers a secure, user-friendly, and cost-effective solution for smart retail environments.

Intelligent Face Recognition–Driven Access Control System Using ESP32-CAM and Machine Learning

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ABSTRACT

This paper presents an advanced access control system that leverages facial recognition technology integrated with the ESP32-CAM module and machine learning techniques to enhance security and automation. The proposed system captures real-time images and processes them using a trained facial recognition model to accurately identify authorized individuals while preventing unauthorized access. By utilizing lightweight algorithms suitable for embedded platforms, the system ensures efficient performance with minimal computational overhead. The ESP32-CAM enables wireless communication and remote monitoring, making the solution cost- effective and scalable for applications in smart homes, offices, and restricted environments. Additionally, the system incorporates real-time alert mechanisms and data logging features to improve reliability and traceability. Experimental results demonstrate high recognition accuracy and fast response time, validating the effectiveness of the proposed approach in providing a secure and intelligent access control solution.

Keywords— Machine Learning, Face Recognition, ESP32-CAM

Federated Attention-Enhanced Temporal Convolutional Networks for Distributed Spectrum Sensing in Cognitive Radio Networks

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ABSTRACT

Spectrum sensing in Cognitive Radio Networks (CRNs) is critical for efficient spectrum utilization under dynamic environments and low Signal-to-Noise Ratio (SNR) conditions. Although Attention-Augmented Deep Temporal Convolutional Networks (AA-DTCN) significantly improve detection accuracy, they rely on centralized training, leading to increased communication overhead and privacy concerns. To address these limitations, this paper proposes a Federated Attention- Enhanced Deep Temporal Convolutional Network (FAE-TCN) for distributed spectrum sensing. The proposed approach integrates temporal convolutional networks with attention mechanisms and federated learning to enable collaborative model training among multiple cognitive radio users without sharing raw data. The model incorporates hybrid feature extraction, multi-scale temporal convolution, and attention-based feature weighting to enhance sensing performance. Experimental results demonstrate that the proposed FAE-TCN achieves improved detection accuracy, reduced false alarm rate, and enhanced robustness under low SNR conditions compared to AA-DTCN and other conventional models. Additionally, it significantly reduces communication overhead and ensures data privacy, making it suitable for large-scale distributed CRNs.

Keywords- Federated Learning, Cognitive Radio Networks, Spectrum Sensing, Temporal Convolutional Networks, Attention Mechanism, Distributed Learning, Low- SNR

An Integrated Explainable AI Framework for Bias Detection, Fairness Evaluation, and Mitigation in Machine Learning Models

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ABSTRACT

Machine learning models are rapidly being used in high-stakes decision-making areas such as recruiting, banking, healthcare, and criminal justice. However, these models frequently inherit and amplify biases in previous data, resulting in unfair and discriminatory outcomes for protected groups. Despite fairness- aware learning approaches and Explainable Artificial Intelligence (XAI) methods have been proposed to solve these issues, existing systems treat bias detection, fairness evaluation, explainability, and mitigation as distinct functions. Furthermore, explainability methodologies do not guarantee fairness and may mislead customers if the underlying models are biased. To address these constraints, this paper introduces an Explainable AI-based paradigm for systematic bias detection, fairness analysis, explanation, and mitigation in machine learning models. The system functions as a unified end-to-end pipeline, combining predictions, fairness measures, and explainability outputs into a single analytical workflow. The approach assesses bias using basic fairness measures including Demographic Parity, Equal Opportunity, and Equalized Odds, and it uses SHAP-based explainability to analyze both global and individual model predictions. To improve ethical dependability, post-processing bias mitigation approaches are used to eliminate unfair outcomes while maintaining predictive accuracy. The productiveness of mitigation is measured by comparing fairness metrics and accuracy before and after mitigation. By integrating fairness evaluation, explainability, and mitigation into a single framework, the proposed system aims to provide a transparent, practical, and dependable approach to detecting and addressing unethical behavior in machine learning models, thereby contributing to the development of responsible and trustworthy AI. The linked outputs also facilitate auditability and ethical risk assessment across numerous datasets and use cases.

Keywords: Bias detection, explainable ai, fairness metrics, machine learning, Shap.

Design and Analysis of an Analog Closed-Loop DC Motor Speed Control System

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ABSTRACT

This paper presents the design and implementation of an analog closed-loop DC motor speed control system using operational amplifiers. The system employs a feedback mechanism in which the motor output is compared with a reference voltage to generate an error signal. This error is processed through a proportional control stage and applied to a MOSFET-based driver to regulate motor speed. The circuit is implemented using an LM358 operational amplifier and tested under varying load conditions. Experimental results demonstrate improved speed stability and reduced variations compared to open-loop operation. Additionally, PID control concepts are analyzed to enhance system performance by reducing steady-state error and improving transient response. The proposed system provides a simple, low-cost, and effective solution for small-scale automation and educational applications.

Keywords— DC Motor, Closed-Loop Control, PID Controller, MOSFET, Operational Amplifier, Speed Control

AI Based Animal Intrusion Detection System for Smart Agriculture near Forest Region

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ABSTRACT

Agriculture faces critical challenges such as inefficient irrigation practices, water scarcity, and crop damage caused by wild animal intrusion, particularly in farms located near forest regions. This paper presents an integrated IoT-based Smart Irrigation and Digital Fence System designed to automate irrigation and enhance farm security through real-time monitoring and intelligent decision-making. The proposed system utilizes a Raspberry Pi-based architecture integrated with soil moisture, temperature, rain, and ultrasonic sensors to continuously monitor environmental conditions. Irrigation is automatically controlled based on soil moisture levels and rainfall detection, ensuring efficient water usage and reduced human intervention. To address crop damage caused by wildlife, the system incorporates an animal intrusion detection mechanism using ultrasonic sensors and camera- based monitoring. Upon detection, alert mechanisms such as buzzers and water spray systems are activated to repel animals, while notifications are sent to the farmer via IoT communication. Additionally, machine learning techniques such as Convolutional Neural Networks (CNN) are used for animal identification, and crop prediction is achieved using data-driven models. Experimental results demonstrate improved water efficiency, reduced crop loss, and enhanced farm security. The proposed system provides a low- cost, scalable, and sustainable solution for smart agriculture, contributing to increased productivity and reduced operational effort.

Keywords- IoT, Smart Irrigation, Animal Intrusion Detection, Raspberry Pi, Soil Moisture Sensor, Ultrasonic Sensor, CNN, Agriculture Automation

Synthesis, Characterization and Bioactivity Evaluation of Gold Nanoparticles from Bacterial Metabolite

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ABSTRACT

Gold nanoparticles (AuNPs) have attracted considerable interest in nanobiotechnology due to their unique optical, chemical, and biological properties, which make them suitable for various biomedical and pharmaceutical applications. The present study aims to investigate the synthesis, characterization, and bioactivity evaluation of gold nanoparticles using bacterial metabolites through an eco-friendly and cost-effective green synthesis approach. Bacterial metabolites obtained from cultured bacterial strains were used as reducing and stabilizing agents for the conversion of chloroauric acid into gold nanoparticles under controlled laboratory conditions. The formation of gold nanoparticles was initially confirmed by a visible color change from light yellow to ruby red, indicating the occurrence of surface plasmon resonance. The synthesized gold nanoparticles were characterized using standard analytical techniques such as UV–Visible spectroscopy, Fourier Transform Infrared Spectroscopy (FTIR), X-ray Diffraction (XRD), and Scanning Electron Microscopy (SEM). These analyses confirmed the successful formation of stable, crystalline, and predominantly spherical nanoparticles with nanoscale dimensions. Functional group analysis suggested that biomolecules present in the bacterial metabolites played an important role in the reduction and stabilization of the nanoparticles. The biological activity of the synthesized nanoparticles was evaluated by antioxidant and antimicrobial assays. The results showed that the gold nanoparticles possessed significant free radical scavenging activity and exhibited inhibitory effects against selected pathogenic microorganisms. The enhanced bioactivity may be due to the combined effect of gold nanoparticles and bioactive compounds present in the bacterial metabolites. This study demonstrates that bacterial metabolite-mediated synthesis of gold nanoparticles is a simple, eco-friendly, and efficient method with promising applications in nanomedicine, drug delivery, and antimicrobial therapy.

Keywords: Gold nanoparticles, Green synthesis, Bacterial metabolites, Characterization, Antioxidant, activity, antimicrobial activity.

DeepViper-IDS: An Attention-Driven Conv-LSTM Framework Optimized by Spider Tailed Horned Viper Algorithm for Intelligent Intrusion Detection

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ABSTRACT

The consistent development of the big networking infrastructure has resulted in the alarming increase in the quantity, diversity and sophistication of the Distributed Denial-of-Service (DDoS) attacks that have become significant threats to data confidentiality, data integrity, and data availability. The conventional intrusion detection systems (IDS) also do not tend to cope with dynamism in traffic patterns and nuanced attack behaviour. In a bid to eliminate these constraints, this paper introduces Deep Learning-Driven Viper Optimization-Based Intrusion Detection System (DeepViper-IDS); which is an intelligent hybrid model of intrusion detection, which combines the deep learning with metaheuristic optimization to attain robust, accurate, and adaptive detection of attacks. The suggested framework starts by normalizing through Euclidean distance which eliminates variability in features and improves model learning. After this, wrapper-based Recursive Feature Elimination (RFE) is used to identify the most discriminative and relevant features, and thus helps to cut down the computational complexity and still preserve key indicators of an attack. The basic detection system employs a Convolutional Long Short-Term Memory (Conv-LSTM) network with an attention mechanism to learn effectively the spatial and temporal correlation of network traffic and enables the model to concentrate

on the most significant features that define attack patterns. In order to enhance even better model performance and rapid convergence, we adopt Spider Tailed Horned Viper Optimization (STHVO) to dynamically optimize weights of the neural network and achieve excellence in convergence and generalization to various traffic scenarios. The efficiency of the model is strictly tested with the help of the CICDDoS2019 dataset which represents the entire picture of the real-life situation with the DDoS attack. The findings of the experiment indicate that DeepViper-IDS is far more effective than traditional IDS frameworks in accuracy, precision, recall, F1-score, and detection rate and has lower false alarm rates.

Keywords: Intrusion Detection System, Conv-LSTM, Attention Mechanism, Recursive Feature Elimination, Spider Tailed Horned Viper Optimization.

AI-Enabled Smart Waste Monitoring and Segregation System Using IoT.

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ABSTRACT
This work proposes an AI-enabled Smart Garbage Monitoring and Segregation System that integrates Internet of Things (IoT) technology with artificial intelligence for efficient waste management. The system uses ultrasonic sensors to monitor the fill level of garbage bins and transmits the data through an ESP32 microcontroller with LoRa communication to a cloud-based platform for real-time monitoring. Additionally, a camera-based waste classification module powered by a convolutional neural network (CNN) running on a Raspberry Pi automatically identifies waste categories such as plastic, paper, metal, glass, and organic materials. The classified waste data and bin status are sent to a cloud dashboard for analysis and decision-making. The proposed system improves waste segregation efficiency, reduces manual intervention, and supports intelligent waste collection, making it a promising solution for sustainable smart city waste management.

Hallucination-Resistant Retrieval-Augmented Generation Framework for Improving the Reliability of Large Language Models

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ABSTRACT

Large Language Models (LLMs) have demonstrated exceptional performance in natural language processing tasks; however, their tendency to generate hallucinated and unverified information remains a critical challenge. In order to increase the factual correctness and dependability of AI-generated responses, this research suggests a Hallucination-Resistant Retrieval-Augmented Generation (HR-RAG) framework. The proposed system integrates vector-based document retrieval, multi-stage re-ranking, and a verification module based on semantic similarity and Natural Language Inference (NLI). By grounding responses in relevant external knowledge and validating their consistency, the framework effectively reduces unsupported and misleading outputs. The implementation leverages pre-trained models and scalable tools to ensure practical applicability. Experimental results demonstrate improved response relevance and a significant reduction in hallucination rates compared to conventional approaches. This research advances the creation of dependable, transparent, and trustworthy AI systems for practical uses.

Keywords:Natural Language Inference (NLI), FAISS, Hallucination Detection, Retrieval-Augmented Generation (RAG), Semantic Similarity, Large Language Models (LLMs), and Reliable AI.

Multi-Objective Task Scheduling Using Genetic Algorithm In Cloud Computing

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ABSTRACT

Efficient task scheduling in cloud computing is crucial for minimizing execution time and energy consumption while maintaining Quality of Service (QoS). Traditional algorithms such as Round Robin (RR) and First come First Served (FCFS) were not built to optimize these objectives collectively, which makes them less effective for managing large-scale and varied cloud workloads. This paper proposes a multi-objective Genetic Algorithm (GA) based scheduling framework that optimizes task allocation across heterogeneous virtual machines by considering makespan, energy usage, and priority aware execution. Its performance is evaluated against RR and FCFS across multiple workloads. The experimental results show that the GA reliably surpasses RR and FCFS in makespan reduction, energy efficiency, resource utilization balance, and priority- based task completion. The approach improves resource utilization and scalability, providing an effective approach to NP-hard cloud scheduling problems.

Keywords: Cloud Computing, Task Scheduling, Genetic Algorithm, Energy Efficiency, makespan , Quality of Service

Secure Autonomous Delivery Robot with Real Time – Tracking

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ABSTRACT

This project presents a Secure Autonomous Delivery Robot with Real-Time Tracking designed to deliver packages automatically without human involvement. In modern cities, increasing traffic and pollution caused by delivery vehicles highlight the need for smart and efficient delivery solutions. The proposed system uses a GPS module to determine the robot's location and a digital compass to maintain the correct direction during navigation. An ultrasonic sensor is used to detect and avoid obstacles, ensuring safe movement. The entire system is controlled by Arduino microcontrollers, where Arduino Mega manages the main operations and Arduino Uno processes compass data. To enhance security, a PIN-based authentication system is implemented, allowing only authorized users to access the package through a keypad interface. In addition to this, Bluetooth communication is integrated to enable wireless control and monitoring of the robot, allowing the user to send deployment commands and receive status updates in real time. After successful delivery and authentication, the robot automatically initiates its return sequence and navigates back to its predefined home location, ensuring a complete and autonomous delivery cycle. This project demonstrates an effective application of embedded systems, automation, and sensor integration to provide a smart, efficient, and secure delivery solution, reducing human effort and improving delivery performance.

Novel Transformer less grid connected solar PV inverter

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ABSTRACT

Transformer less grid-connected photovoltaic (PV) inverters have gained significant attention due to their high efficiency, reduced cost, and compact structure compared with conventional transformer-based systems. However, transformer less topologies often suffer from leakage current caused by common-mode voltage variations, which may lead to electromagnetic interference and safety concerns. This project presents a Novel transformer less single-stage grid-connected solar inverter designed to enhance efficiency while effectively eliminating leakage current. The proposed topology integrates a bidirectional DC–DC boost converter with a flyback inductor inverter in a single-stage configuration, thereby reducing component count, power losses, and system complexity. A common-ground configuration, where the PV negative terminal is directly connected to the grid neutral, is implemented to suppress leakage current. The system employs Sinusoidal Pulse Width Modulation (SPWM) along with a Proportional Resonant (PR) current controller to ensure accurate sinusoidal grid current tracking with zero steady-state error. Grid synchronization is achieved using a Phase-Locked Loop (PLL), while a Perturb and Observe Maximum Power Point Tracking (MPPT) algorithm enables optimal power extraction from the PV array under varying environmental conditions. The proposed inverter is modelled and simulated using MATLAB/Simulink, and the results demonstrate improved efficiency, low total harmonic distortion (THD) within IEEE standards, and near-zero leakage current. The compact and cost-effective design makes the proposed inverter suitable for residential rooftop systems, commercial installations, and grid-connected solar applications.

Keywords— Transformer less inverter, photovoltaic (PV) systems, grid-connected inverter, leakage current suppression, maximum power point tracking (MPPT), proportional resonant controller, sinusoidal pulse width modulation (SPWM).

Distribution Line Fault Detection and Alerting System

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ABSTRACT

In modern power systems, maintaining a reliable and continuous electricity supply is essential, but faults in transmission lines often lead to outages and service disruptions. Traditional fault detection methods are slow and require manual inspection, which delays recovery. To address this issue, this project proposes an iot based transmission line fault detection and alerting system capable identifying faults between different nodes in real time. Transmission line is modeled using a series of interconnected nodes: a starting node where current begins, followed by other nodes with one, two, or three branches. Sensors are placed at each node to monitor electrical parameters such as current and voltage. These sensors are connected to a microcontroller which processes the data and identifies abnormal patterns that indicates fault between nodes. Once a fault is detected, the system sends this information to a cloud server and displays the exact fault location on a dedicated web application, providing utility staff with instant alerts and a clear view of the transmission network. The system was tested and successfully detected faults between various node combinations, showing the exact location and type of fault. By enabling faster response times, reducing manual inspection, and improving the reliability of fault detection, this project has a significant impact on power system monitoring and supports the development of smarter, more efficient electrical infrastructure.

Smart Electricity Consumption Forecasting With Proactive Alert System

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ABSTRACT

Accurate forecasting of electricity consumption is essential for effective energy management, cost optimization, and sustainable utilization, especially in residential and small-building environments. The demand for energy has increased dramatically due to urbanization, population growth, and widespread usage of electrical products. Traditional billing systems provide feedback only after consumption, limiting users' ability to control usage in advance. The study suggests an intelligent, consumer-focused electricity forecasting and alert system that uses machine learning approaches to address this. Using previous data and variables like temperature, humidity, and seasonal fluctuations, the system forecasts monthly electricity consumption. Preprocessing and feature engineering are used to support models such as Random Forest, XGBoost, and SVR.. The system also allows user input-based prediction.Estimated bills are created from predicted use and compared to past usage. Increased awareness, efficiency, and sustainable energy management are achieved by generating alerts for excessive usage.

Keywords:Electricity Consumption Forecasting, Machine Learning, Energy Management, XGBoost,
Load Prediction, Bill Estimation, Alert System

AI Agent Using LiveKit and Gemini API: A Real-Time Intelligent Communication System

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ABSTRACT

This paper presents the design and implementation of an intelligent AI agent that integrates Google's Gemini API with the LiveKit framework for real-time multimodal commu- nication. The system supports synchronous voice, video, and text interaction between users and the AI agent, achieving low latency and high-quality performance. The framework leverages LiveKit's WebRTC-based real-time transmission and Gemini's contextual reasoning capabilities. The paper covers architec- ture, methodology, system integration, and performance analysis, highlighting its applications in virtual assistants, education, and telepresence.

Keywords—Artificial Intelligence, LiveKit, Gemini API, WebRTC, Real-Time Systems, Multimodal AI

Community Health Early Warning Model using Machine Learning

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ABSTRACT

This paper proposes a machine learning based Community Health Early Warning System which is introduced with the potential to predict possible diseases that might occur in the community in the near future, as well as to assess the health risks involved. The system is designed to combine various data sets such as diseases, climatic conditions, and demographic information to detect the health trends that are arising. The machine learning approach is used to analyse the trends and predict the possible diseases that might occur in the community at an early stage. The proposed system is aimed at helping the health authorities make the right decisions regarding the allocation of resources to reduce the impact of diseases occurring in the community.

Keywords: Community Health, Disease Forecasting, Machine Learning Models, Time Series, Health Data Analytics, Risk Prediction, Epidemiological Data

Smart Prediction of Knee Osteoarthritis Severity Using Machine Learning: Advancing Exercise and Preventive Care

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ABSTRACT

Knee osteoarthritis (KOA) is a leading cause of disability worldwide, often diagnosed at advanced stages, limiting the effectiveness of early intervention and rehabilitation strategies.To develop a machine learning model to predict KOA severity and guide personalized rehabilitation. To develop and validate a machine learning-based model for predicting the severity of KOA to support early, personalized physiotherapy management.A cross-sectional dataset comprising clinical, functional, and radiological parameters from individuals with KOA was analyzed. Machine learning algorithms, including Random Forest and Support Vector Machine, were employed to classify disease severity. Model performance was evaluated using accuracy, precision, and recall metrics. The proposed model demonstrated high predictive performance, achieving an accuracy of approximately 90% in classifying KOA severity. The model showed strong correlation with functional outcome measures, indicating its potential clinical applicability in early diagnosis and intervention planning. This AI-driven predictive model offers a promising tool for early identification of KOA severity, enabling timely and personalized rehabilitation strategies. Its implementation may reduce disease progression, improve functional outcomes, and enhance accessibility to preventive care in diverse healthcare settings.

Keywords: Knee Osteoarthritis, Machine Learning, Severity Prediction, Exercise Therapy, Rehabilitation, Preventive Strategies, Artificial Intelligence, Physiotherapy

Performance Comparison of SWIPT Receiver Architectures for Wirelessly Powered Sensor Devices: Toward Energy-Efficient, Low-Carbon IoT

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ABSTRACT

SWIPT has become a central facilitator of batteryless sensor networks based on sustainable operation, in which energy harvesting and data communication need to be performed at stringent power and latency factors. A more sophisticated analysis and simulation model to compare three large SWIPT receiver designs: Power Splitting, Time Switching, and Antenna Switching, based on nonlinear RFDC conversion models, rate energy tradeoff equations, and power constraints of circuits. The proposed optimization-based SWIPT design is shown to increase the harvested energy by 32.8%, throughput stability by 24.1%, latency by 27.4%, and overall energy efficiency by 19.6%, when compared to conventional designs. Besides, carbon-impact analysis reveals the decrease in energy- related emissions by 14.3% which proves evident sustainability benefits. The results affirm that the combination of adaptive splitting factors, dynamic switching intervals, and architecture-conscious control is very important in improving energy autonomy. It finds that optimized SWIPT receivers have the potential to transform the way of deploying low-carbon and self-powered IoT systems.

Keywords - Power Splitting, Time Switching, Antenna Switching, Rate–Energy Fusion Index, Direct Current, Received Power, Simultaneous Wireless Information and Power Transfer

Deep Learning-Based Medical Image Preprocessing and Segmentation for Early Detection of Pancreatic Cancer.

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ABSTRACT

Pancreatic cancer is one of the most serious and life-threatening diseases, mainly because it is often detected at a late stage. Medical imaging techniques like CT scans help doctors identify tumors, but accurately separating (segmenting) the pancreas and cancerous regions is still very challenging due to low contrast, noise, and the complex structure of the organ. In this study, an automated approach is proposed to improve the segmentation of pancreatic cancer using enhanced image preprocessing techniques along with the U-Net deep learning model. The preprocessing step focuses on improving image quality by reducing noise, adjusting intensity levels, and enhancing contrast, making the important features more visible and easier to analyze. After preprocessing, the images are processed using the U-Net model, which is well-known for its effectiveness in medical image segmentation. The model helps in accurately identifying and outlining the tumor regions from the surrounding tissues. The results show that this combined approach improves segmentation performance and provides more reliable outputs.This work aims to support doctors by providing a more accurate and efficient tool for detecting and analyzing pancreatic cancer, which can ultimately help in better diagnosis and treatment planning.

Keywords- Pancreas, cancer, CT, U-net, Deep learning, CLAHE

Review on Recent Hierarchical Learning Models For Automated Cervical Cancer Screening Using Pap Smear Cytology

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ABSTRACT

It affects the cervix, which located at the bottom of the uterus and is connected to the vagina. Proper detection and classification of the disease play an important role in improving survival rates. Papanicolaou (Pap) and liquid Based Cytology (LBC) are the most commonly used methods. Advancements in technologies, especially hierarchical methods (Machine learning and deep learning) enhance the automation, efficiency, and a cervical cancer accuracy of cervical cancer (CC) testing. This review introduces a detailed vision of the recent technology based on deep multi-level learning architecture used for early finding and classification and discusses the lack of advancements in studies to obtain an outline of future related work. The insights offered in this paper aim to contribute knowledge to researchers and medical experts to make out the advancements in recent research and the limitations they have faced while dealing with cervical cell cytology.

Keywords—Cervical Cancer, LBC, Pap smear test, Deep learning

An Analysis of Public-Key Cryptography (PKC) Architecture Using Cryptographic Algorithms

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ABSTRACT

Hardware security plays a significant role in protecting the devices and data from the stealing. Hardware-based security solutions deliver better security than software security, which is essential in today handheld devices. However, hardware trustworthiness has become In this work, the widely used PKC algorithm such as RSA and ECC have been implemented to emphasise their importance in data security. The VLSI architecture for the Fast Modular Exponentiation Algorithm (FMEA) is proposed and implemented in the RSA algorithm. Implementation of ECC over GF(p) with underlying mathematical fields is also done. The architecture is described using Verilog HDL (Hardware Description Language), synthesised and verified in ZED (Zynq Evaluation and Development) Board (XC7Z020CLG484-1).

Keywords: Public-key cryptosystem PKC, Hardware security, RSA, ECC, FPGA

Ant Colony Optimization (ACO) with Convolutional Neural Networks (CNNs) for Enhancing Quality of Service (QoS) and Energy Efficiency in Small Cell Deployment in 5G Network

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ABSTRACT

The increasing demand for high-speed data services in 5G networks has led to a significant rise in energy consumption and a corresponding decrease in Quality of Service (QoS). As network operators strive to meet user expectations for seamless connectivity, the need for efficient resource management becomes paramount. To address these challenges, this paper proposes a novel hybrid framework that integrates Ant Colony Optimization (ACO) and Convolutional Neural Networks (CNNs) to optimize small cell deployment in 5G networks. The proposed framework aims to maximize QoS by enhancing signal strength and reducing latency, while simultaneously minimizing energy consumption. By leveraging the strengths of ACO for path optimization and CNN for predictive analytics, the framework effectively balances the trade-offs between performance and energy efficiency. Simulation results demonstrate that the hybrid ACO-CNN framework significantly outperforms standalone ACO and CNN approaches, achieving notable improvements in energy efficiency, network throughput, and overall QoS metrics. These findings highlight the potential of the hybrid model as a viable solution for optimizing small cell deployment in the evolving landscape of 5G technology, ultimately contributing to more sustainable and efficient network operations.

Performance Analysis of Network Slicing Model for 5G

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ABSTRACT

Fifth generation (5G) network slicing enables dynamic partitioning of physical infrastructure into multiple logical networks supporting enhanced mobile broadband (eMBB), ultra-reliable low-latency communication (URLLC), and massive machine-type communication (mMTC). However, efficient and secure resource allocation across slices remains challenging due to scalability, data-privacy, and trust constraints. This paper presents an Adaptive and Secure Resource Allocation Framework integrating Federated Reinforcement Learning (FRL) into the traditional MJNN + EPTO + MMS pipeline The proposed framework enhances classification accuracy, improves resource allocation efficiency, and supports adaptive decision-making for dynamic network slicing environments. By integrating hybrid optimization and deep reinforcement learning techniques, the model significantly improves Quality of Service (QoS) and Quality of Experience (QoE) in next- generation 5G communication networks.

Experimental Investigation of Structural Parameter Influence on Mechanical Response of a 3D Printed Lumbar Intervertebral Disc Model

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ABSTRACT

In this work, we carried out a systematic experimental investigation into how different structural parameters affect the mechanical response of a 3D-printed lumbar intervertebral disc model. By using Fused Deposition Modeling (FDM) as the additive manufacturing method, we printed disc analogues / models using thermoplastic polyurethane (TPU), mainly because of its hyper elastic nature and the way it closely mimics soft biological tissues. For the innovation, we involved some important printing parameters like infill density and infill architecture, to see how these factors influence the compressive mechanical behavior of the disc To analyze this, quasi-static compression tests were performed, which helped us measure things like load–displacement response, stiffness, and the energy absorption capacity of the disc models What stood out from the results is a clear and strong link between the chosen infill parameters and how the model performed mechanically: higher infill density led to greater compressive stiffness and better load-bearing ability, while lower density boosted compliance and deformation capabilities. Changing the infill geometry has also played a role in impacting both stress distribution and the overall structural integrity when the loads were applied. The findings really highlight how FDM-based fabrication can be used to tune the biomechanical properties by altering the design parameters. Overall, this study gave some important groundwork for creating patient- specific intervertebral disc models and created a pathway for developments in advanced biomechanical testing methods, improved surgical planning, and even in regenerative medicine applications in the future.

The Role of AI Smart Mirrors in Posture Correction and Remote Physiotherapy

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ABSTRACT

AI-enabled smart mirrors analyze patient posture and movements, delivering instant corrective feedback to support accurate, engaging, and efficient physiotherapy rehabilitation sessions. To enhance rehabilitation outcomes through accurate, feedback-based physiotherapy using AI smart mirrors. To monitor patient movements, provide corrective feedback, improve exercise adherence, and enable remote physiotherapy. The system uses a camera, sensors, and AI algorithms to track body posture. It compares patient movements with standard models and gives visual/audio feedback. Improved exercise accuracy, better patient engagement, reduced therapist workload, and effective home-based rehabilitation were observed. AI smart mirrors offer a cost-effective, accessible, and efficient solution for modern physiotherapy practice and telerehabilitation.

Keywords-AI smart mirror, physiotherapy, rehabilitation, posture analysis, computer vision, feedback system, telehealth.

Secure IoT-Based Smart Home Automation System Using Blockchain Technology

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ABSTRACT

This paper presents a secure smart home automation system integrating Internet of Things (IoT) with blockchain technology. Traditional IoT systems rely on centralized architectures, making them vulnerable to cyberattacks, unauthorized access, and data breaches. To address these challenges, the proposed system utilizes a decentralized blockchain network to ensure secure communication, data integrity, and reliable user authentication. IoT devices, including sensors and smart appliances, communicate through a gateway and interact with blockchain using smart contracts. These contracts automate device operations while maintaining transparency, traceability, and trust among users. The system eliminates single points of failure and enhances privacy through strong cryptographic mechanisms. Furthermore, it improves scalability and resilience in dynamic smart home environments. Experimental analysis demonstrates that the integration of blockchain with IoT significantly enhances system security and performance. This approach provides a robust and efficient solution for next-generation smart home automation applications worldwide.

Keywords - IoT, Blockchain, Smart Home, Security, Smart Contracts, Decentralization

Accident Forensic and Analysis System using IoT-Based Vehicular Data Logging (Black Box Model)

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ABSTRACT

Road accidents are a major cause of fatalities, yet investigations often lack reliable vehicle data. This project presents an IoT-based Vehicular Data Logging system (Black Box Model) to monitor and analyze vehicle conditions during collisions. The system integrates an ESP32 microcontroller with an MPU6050 accelerometer and vibration sensor to detect impacts, while a GPS module tracks real-time location. Additionally, gas and temperature sensors monitor post-accident fuel leakages or fire risks. All data is processed by the microcontroller and displayed locally via an I2C LCD and, upon impact a GSM module automatically transmits alert messages with coordinates to emergency contacts. By making use of IoT technology, the collected data is uploaded to a cloud platform for remote forensic analysis. By providing vital evidence and accurate data for accident reconstruction, this solution aims to contribute to enhanced road safety and to improve emergency response efficiency.

Keywords - IoT, ESP32, MPU6050, Vehicular Black Box, Accident Forensics, GSM/GPS

mmWave-Enabled ESP32 Mesh for Post-Disaster Human Detection

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ABSTRACT

This paper presents a low-cost ESP32-based mesh network integrated with mmWave human-presence sensors for detecting survivors trapped under debris after disasters. Traditional methods such as thermal imaging and acoustic detection are often slow, expensive, or ineffective in materials like wood and plastic. The proposed system deploys multiple ESP32 nodes equipped with mmWave sensors that can detect human breathing and micro-motions through debris. These nodes form an ESP-MESH network and transmit alerts to a root node outside the structure. Using RSSI-based signal strength, the system estimates the approximate location of survivors, providing real-time guidance to rescue teams. This solution enhances search efficiency by offering continuous, intelligent, and scalable human detection in post-disaster scenarios.

Keywords: ESP32, mmWave Sensor, Mesh Network, Disaster Management, Human Detection

Analysis of 8×8 Sram Arrays Employing 10t Cells In 90nm Technology (Decoder-Free Design)

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ABSTRACT

An 8x8 Static Random Access Memory (SRAM) array based on a 10-transistor (10T) SRAM cell implemented in 90 nm CMOS technology is designed and analyzed in this study. Compared to traditional SRAM architectures, the suggested design aims to increase read stability and lower leakage power. With the proper peripheral hardware, such as wordline drivers and bitline control circuits, the 64-cell array is arranged in a matrix layout.The dynamic behavior of the SRAM cell during read and write operations is assessed using transient analysis. To verify the design efficiency, key performance metrics including read delay and power consumption are examined, and matching power and timing graphs are produced. Area optimization and parasitic effects are carefully taken into account when designing the physical arrangement of the 10T SRAM cell and the entire 8x8 array. Standard checks are used in design verification to guarantee accuracy and manufacturability. The design is appropriate for low- power memory applications since the findings show increased stability, lower power consumption, and dependable operation.

Design and Implementation of Car Parking Management System Using Verilog HDL

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ABSTRACT

In today's fast-paced urban environments, efficient car parking management systems are essential to reduce congestion and improve the utilization of available parking spaces. This project focuses on the design and implementation of an advanced car parking management system using Verilog, a hardware description language widely used for digital system design and verification. The system aims to automate the process of monitoring and managing car park occupancy, ensuring optimal space utilization and enhancing user convenience. The proposed car parking management system leverages Verilog to design a robust and efficient hardware solution capable of real-time monitoring and control. The system is designed to detect the presence of vehicles using sensors at the entry and exit points of the parking area. By integrating these sensors with a digital counter, the system can accurately keep track of the number of vehicles currently in the parking lot. This data is then processed and displayed on an LED screen, providing real-time information to users about available parking spaces. To ensure the reliability and accuracy of the system, various Verilog constructs such as finite state machines (FSMs), registers, and counters are utilized. The design process involves creating a detailed Verilog model, simulating the system behavior, and verifying its functionality through testbenches. The implementation phase includes synthesizing the Verilog code onto a Field Programmable Gate Array (FPGA) to create a prototype of the car parking management system. This approach not only validates the design but also demonstrates the practical feasibility of using Verilog for real-world applications. The final prototype is evaluated based on its performance, accuracy, and response time.The results indicate that the Verilog-based car parking management system provides a highly efficient and scalable solution for modern parking facilities. By automating the parking process, this system can significantly reduce the time spent searching for parking spaces, enhance user experience, and contribute to smarter city infrastructure. Future enhancements may include the integration of wireless communication modules and mobile applications to further improve user interaction and system flexibility.

FSM-Based Serial Data Communication Controller

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ABSTRACT

This project presents the design and implementation of a Finite State Machine (FSM)-based Serial Data Communication Controller, aimed at enabling reliable data transmission between digital systems. The controller manages the complete process of serial communication by converting parallel input data into a serial bit stream for transmission and reconstructing the original data at the receiver end. The system is divided into two main modules: transmitter and receiver, both designed using FSM principles. The transmitter FSM controls the sequence of operations including idle state, start bit generation, and data bit transmission, parity handling (optional), and stop bit generation. Similarly, the receiver FSM is responsible for detecting the start bit, sampling incoming data bits at appropriate clock intervals, validating the received. The design ensures proper synchronization and timing control, which are critical in serial communication systems. Additional features such as error detection, configurable baud rate, and data framing can be incorporated to enhance performance and flexibility. The entire system can be implemented using hardware description languages such as Verilog or VHDL and verified through simulation tools like Model Sim or Synopsys.

DOSTH: Driving Optimizer for Safety and Traffic Harmony

(A Deterministic Multi-Agent IoT Traffic Coordination Framework with Quantitative Validation Under Heterogeneous Indian Road Conditions)

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ABSTRACT

DOSTH (Driving Optimizer for Safety and Traffic Harmony) is a deterministic, multi-agent traffic coordination framework designed for heterogeneous and unstructured urban environments characteristic of Indian road conditions. Unlike purely reactive models, DOSTH employs a rule-based, explainable control architecture integrating time-to-collision–based safety regulation, adaptive speed harmonization, and decentralized, conflict-aware junction arbitration. The system is structured as a lightweight IoT framework deployable on resource-constrained edge devices with realistic sensing noise and communication delays. A discrete-time simulation platform (Py based) evaluates DOSTH against the Intelligent Driver Model (IDM) and a stochastic driver baseline across multiple scenarios, including a high-density nine-junction urban grid. Across repeated trials, DOSTH achieves substantial reductions in collision rate, speed oscillation, and junction delay compared to the stochastic baseline, while maintaining stable performance under uncertainty. These results demonstrate that deterministic, decentralized coordination can significantly enhance traffic efficiency, stability, and safety in complex mixed-traffic environments.

Keywords- Autonomous vehicles, collision avoidance, deadlock prevention, deterministic control, ESP32, heterogeneous traffic, Indian road conditions, IoT vehicular networks, junction arbitration, multi-agent systems, time-to- collision, traffic harmonization, V2V coordination.

AUTHENTIX: Multimedia Fake Detection Using AI and Deep Learning

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ABSTRACT

The rapid growth of social media has increased the spread of fake information in various forms, including text, images, videos, and audio. Existing detection systems often focus on a single data type, reducing their effectiveness against modern misinformation. This paper presents AuthentiX, a multi-modal fake content detection system using Artificial Intelligence (AI) and Deep Learning (DL). The system analyzes textual data, detects deepfake images and videos, and verifies multimedia authenticity in real time. It also supports multilingual content to address global misinformation challenges. By combining feature extraction, sentiment analysis, and cross-modal verification, AuthentiX provides a unified approach to identify manipulated and misleading content. The proposed system aims to improve trust, transparency, and reliability in digital platforms while offering a scalable solution to combat misinformation.

Keywords: Fake News Detection, Deep Learning, Deepfake Detection, Multi-Modal Analysis, Social Media

PERINFEX-VIS: Data Augmentation and Preparation for a Persian Chatbot with Information Extraction and Visual Story Generation

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ABSTRACT

In recent years, advancements in artificial intelligence have enabled innovative applications in conversational systems, information extraction, and visual storytelling. This paper presents PERINFEX-VIS, an enhanced Persian-language chatbot that integrates information extraction with sequential visual story generation capabilities. The system addresses challenges associated with low-resource languages by employing effective data augmentation and preprocessing techniques tailored to Persian linguistic structures. The data preparation pipeline includes text cleaning, normalization, tokenization, and annotation, along with augmentation strategies to expand limited datasets. The chatbot leverages natural language processing techniques to extract key information from user inputs and identify important narrative elements. These elements are then transformed into visual representations using deep learning models, including Convolutional Neural Networks (CNNs), to generate a sequence of images that align with the story flow. The proposed system bridges the gap between textual understanding and visual representation, enabling both structured information extraction and interactive storytelling. Experimental results demonstrate improved performance in both language understanding and visual generation tasks. This work highlights the potential of combining data-centric approaches with multimodal AI systems to enhance user engagement in education, entertainment, and intelligent applications.

Keywords
Persian Chatbot, Data Augmentation, Information Extraction, Visual Storytelling, Deep Learning, CNN, Natural Language Processing, Multimodal AI

AI-Driven Optimization Techniques for Renewable Energy Systems

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ABSTRACT

The rising need for renewable energy solutions, facing the challenges in optimizing renewable energy systems in energy-starved regions, and addressing the growing global energy discrepancy. This paper leverages Reinforcement Learning and Generative Adversarial Networks(GANs) to optimize the renewable energy configurations including solar panel placements and, wind turbine configurations and storage systems based on the environmental features like wind speed, sunlight, and geography. In this approach, the proposed paper work applies Generative Adversarial Networks (GANs), In GAN architecture, the generator network creates optimal energy solutions based on environmental conditions and the discriminator evaluates the generated solutions based on the feasibility of real-world energy setups, and classifying them as either realistic or infeasible. Reinforcement Learning is utilized to forecast energy demand trends and modify energy systems in real-time, thereby facilitating effective energy distribution and storage. The implementation of these solutions has the potential to enhance energy accessibility and sustainability in marginalized areas, facilitating the effective utilization of renewable resources while alleviating energy poverty. The proposed methodology guarantees a consistent energy supply by providing optimized renewable energy configurations such as placement of solar panels and wind turbines and also provides real-time energy optimization recommendations such as energy demand prediction and real –time monitoring dashboards . This initiative seeks to deliver

scalable and adaptable AI-driven renewable energy solutions that can be globally deployed in low-income communities, thereby guaranteeing consistent and dependable energy access.

Keywords - Generative Adversarial Networks(GANs), generator, discriminator, Reinforcement Learning

Partial FFT Demodulation for MIMO-OFDM Over Time Varying Underwater Acoustic Channel

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ABSTRACT

Underwater communication is very difficult because water causes signal distortion, noise, and time variations. When signals travel underwater, they change due to movement of water, waves, and objects. This makes communication less reliable.In this project, we study a communication system called MIMO-OFDM (Multiple Input Multiple Output – Orthogonal Frequency Division Multiplexing). MIMO uses multiple antennas to send and receive signals, which improves data speed and reliability. OFDM divides the signal into many small parts so it can handle distortion better.However, in underwater channels, the signal changes over time. This causes a problem called Doppler effect, which distorts the signal frequency.To solve this problem, we use a method called Partial FFT Demodulation. This technique helps reduce the effect of time variation and Doppler distortion. It improves signal detection and overall system performance.The main aim of this project is to improve underwater communication performance by using Partial FFT Demodulation in a MIMO-OFDM system over a time-varying underwater acoustic channel

Keywords: MIMO-OFDM , Partial FFT Demodulation , Underwater Acoustic Communication, Time-varying Channel, Doppler Effect , Signal Demodulation

Data-Driven Optimization of Construction Productivity in Commercial Buildings Using Genetic Algorithm

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ABSTRACT

This study focuses on the optimization of time, cost, and resource utilization in commercial building construction using a Genetic Algorithm approach. The increasing complexity of modern construction projects necessitates the adoption of advanced techniques beyond traditional scheduling methods. Conventional methods such as CPM and PERT are limited in handling multi-objective optimization problems involving conflicting project parameters. This research aims to develop an efficient optimization framework that integrates time, cost, and resource constraints. A detailed literature review was conducted to identify research gaps and establish the theoretical foundation of the study. A structured methodology was adopted, including data collection, problem formulation, and model development. Project data such as activity durations, costs, and resource requirements were analyzed

to represent real construction scenarios. An optimization model was formulated with defined objective functions and constraints. A Genetic Algorithm was implemented using MATLAB to generate optimal and near-optimal solutions. The algorithm employed operations such as selection, crossover, and mutation to improve solution quality iteratively. The optimized results were compared with traditional scheduling methods to evaluate performance improvements. The findings demonstrate significant reductions in project duration and cost along with improved resource utilization. This study provides a practical and efficient approach for enhancing construction project management and supports decision-making in commercial building projects.

Keywords: Genetic Algorithm, Cost overrun, Time overrun, Construction Projects

Multi-Platform E-Commerce Price Comparison System Using Web Scraping

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ABSTRACT

The rapid expansion of e-commerce platforms has made it difficult for consumers to identify the most cost-effective products. This paper presents a multi-platform e-commerce price comparison system using web scraping techniques to collect real-time product data from various online marketplaces. The system extracts key information such as product name, price, ratings, and availability, and displays it through a unified interface for easy comparison. It incorporates filtering and sorting mechanisms to improve user decision- making and reduce search time. The system is designed to handle dynamic website structures, ensuring accurate and reliable data extraction. By providing transparent price comparisons, the proposed solution enhances user experience and supports smarter purchasing decisions in the digital marketplace.

Keywords: Web Scraping, E-Commerce, Price Comparison, Data Extraction, Automation

Analysis of Adaptive Notch Filter Based Active Damping for LCL Filter Based Shunt Active Power Filter

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ABSTRACT

The LCL filter is widely used in grid-connected converters due to its strong attenuation of switching ripple harmonics and reduced inductance requirement compared to conventional L-type filters. However, the resonance introduced by the LCL structure can significantly reduce the stability margin of the current control loop, especially in Shunt Active Power Filter (SAPF) applications where harmonic compensation is required over a wide frequency range. This paper presents a detailed modelling and analytical study of an SAPF interfaced with the grid through an LCL filter and employing a notch filter based active damping strategy. The continuous-time model of the LCL filter is derived and its resonance characteristics are examined. The system is then transformed into the discrete domain considering PWM delay and digital implementation. A notch filter is designed to suppress resonance by introducing anti-resonance at the LCL resonance frequency. To maintain damping effectiveness under grid impedance variation, adaptive tuning based on grid inductance estimation is incorporated. Stability is evaluated using frequency response and pole-zero analysis. The results confirm effective resonance suppression and robust operation under grid variations.

Keywords: Shunt Active Power Filter, LCL Filter, Active Damping, Notch Filter, Grid Impedance Estimation, Digital Control, Stability Analysis

Power Quality Improvement in EV Charging Stations Using Super-Twisting Sliding Mode Controlled Shunt Active Power Filter

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ABSTRACT

The rapid growth of Electric Vehicle (EV) charging stations is introducing significant power quality issues in electrical distribution systems. These issues arise due to the use of power electronic converters in EV chargers, which generate harmonic currents, consume reactive power, and cause voltage distortion at the Point of Common Coupling (PCC). Such disturbances reduce system efficiency and adversely affect nearby electrical equipment. This paper presents an effective approach for improving power quality in EV charging systems using a Shunt Active Power Filter (SAPF) controlled by a Super-Twisting Sliding Mode Control (STSMC) technique. The SAPF compensates for harmonic currents and reactive power by injecting appropriate compensating currents into the system. The proposed system is modelled and simulated using MATLAB/Simulink, where the EV charger is represented as a nonlinear load consisting of a diode rectifier and a DC-link converter. Simulation results demonstrate significant reduction in harmonic distortion and improvement in source current waveform, ensuring compliance with IEEE-519 standards. The proposed method effectively minimizes Total Harmonic Distortion (THD) and enhances overall power quality in EV charging applications.

Keywords— Electric Vehicle Charger, Power Quality, Shunt Active Power Filter, Super-Twisting Sliding Mode Control, Harmonic Compensation, MATLAB/Simulink.

CART BOT: Shop Smart with Automation

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ABSTRACT

The retail sector is rapidly evolving with the adoption of automation, robotics, and intelligent technologies to improve operational efficiency and customer convenience. This project introduces CartBot, an autonomous shopping assistant designed to address common challenges in traditional retail environments, including product search difficulties, long checkout times, and limited customer assistance. The system integrates voice-based interaction, autonomous navigation, robotic arm manipulation, and RFID-enabled automatic billing to streamline the shopping process. CartBot navigates predefined store layouts, identifies products, and performs pick-and-place operations while ensuring safe movement through obstacle detection mechanisms. Real-time billing and transaction updates are displayed on an onboard interface or connected mobile application. The architecture utilizes embedded controllers, sensor modules, and IoT communication to create an efficient and user-friendly smart retail solution. The system enhances accessibility, reduces manual workload, and demonstrates the practical application of intelligent automation in modern retail environments.

Keywords - Smart Shopping Robot, Autonomous Navigation, RFID-Based Billing, Voice-Controlled Robotics, Retail Automation, Internet of Things (IoT), Human–Robot Interaction, Assistive Robotics

Driver Drowsiness Detection Using Computer Vision

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ABSTRACT

Driver drowsiness is a major cause of road accidents, leading to severe injuries and fatalities. This project presents a real-time driver drowsiness detection system using computer vision techniques. The system utilizes a camera to monitor the driver facial features, particularly eye movements and blinking patterns, to identify signs of fatigue. Advanced image processing and machine learning algorithms are employed to detect eye closure duration and head position. When drowsiness is detected, the system triggers an alert to warn the driver, helping prevent potential accidents. The proposed system is efficient, non-intrusive, and can be implemented in modern vehicles to enhance road safety.

Keywords - Computer Vision, Drowsiness Detection, Eye Tracking, Machine Learning, Road Safety

Visual Inspection and Dimension Analyzer using Raspberry Pi

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ABSTRACT

This project presents a cost-effective automated system for visual inspection and dimensional analysis using a Raspberry Pi 4 Model B. The system utilizes a camera module to capture images of objects and processes them to identify defects and measure dimensions accurately. It compares the captured data with predefined standards to ensure quality compliance. The proposed solution is especially beneficial for small and medium-scale industries where manual inspection is time-consuming and prone to human errors. By automating the inspection process, the system enhances productivity, improves accuracy, and ensures consistent quality control. It reduces dependency on manual labor and minimizes operational costs. Additionally, the system is flexible and can be adapted for different industrial applications such as manufacturing, packaging, and assembly line monitoring, making it a practical solution for modern quality assurance needs.

Keywords - Raspberry Pi, Visual Inspection, Dimension Analysis, Automation, Quality Control, Image Processing

Smart Energy Harvesting from Wastewater Flow Using Micro Hydro Turbine

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ABSTRACT

In an era focused on clean energy, this project converts wastewater flow into electricity using a compact micro hydro turbine. Flowing water spins the turbine, generating mechanical energy that is converted into electrical power. Sensors monitor voltage and current, while a controller regulates battery charging. An Arduino processes data and displays real-time readings on an LCD. With ESP8266 Wi-Fi, system data is transmitted online, demonstrating wastewater as a sustainable, smart energy source.
Keywords **- Renewable energy, wastewater power generation, micro hydro turbine, Arduino monitoring system, IoT-based energy tracking, sustainable energy recovery**

YOLOv11-Based Real-Time Suspicious Object Detection and Alert System with Analytics Dashboard

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ABSTRACT

This project implements a real-time object detection and monitoring system using the YOLOv11 model to identify multiple suspicious objects, including knife, gun, axe, crowbar, torch light, and black mask. Users can upload images or stream live camera feeds, and the system analyzes them to detect the presence of these objects with high accuracy. Immediate alerts are provided via flash messages and optionally through WhatsApp or email notifications. A comprehensive dashboard displays analytics of detected objects over time using stacked bar charts, and users can download reports in CSV format. The application incorporates user authentication and role-based access, ensuring secure usage. This solution demonstrates the effectiveness of YOLOv11-based detection combined with practical alerting, analytics, and reporting for enhanced security monitoring.

Comparative Study of Denoising Techniques for SNR Enhancement in Burst-Type Underwater Acoustic Signals under Rain Noise

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ABSTRACT

Burst type acoustic signals used in underwater detection and communication applications suffers severe signal-to-noise ratio (SNR) degradation under rain noise conditions. This paper presents a comprehensive comparative analysis of SNR enhancement techniques for burst-type underwater acoustic signals contaminated with real rain noise. Classical linear filtering methods like bandpass finite impulse response (FIR) filtering and matched filtering methods are evaluated alongside advanced denoising approaches such as wavelet-based denoising, empirical mode decomposition (EMD), and adaptive least mean square (LMS) filtering. Furthermore, hybrid processing frameworks combing these techniques are also investigated to exploit their individual strengths. Performance evaluation is carried out using burst-only SNR metrics to ensure physically meaningful assessment. Experimental results demonstrate that conventional linear filtering provides limited SNR improvement due to the broadband nature of rain noise. Wavelet and EMD-based methods achieve moderate enhancement by exploiting time frequency localization and adaptive decomposition, respectively. Adaptive LMS filtering effectively suppresses correlated noise components but leaves residual broadband interference. The proposed hybrid LMS wavelet approach achieves the highest SNR improvement, reaching up to 12.076 dB, by combining adaptive noise cancellation with multiresolution thresholding. The comparative results confirm that hybrid denoising strategies offer superior performance for burst-type underwater acoustic signals in highly non-stationary noise environments.

Keywords - SNR , Wavelet, LMS EMD, FIR, Underwater Noises

ECG Signal-Based Identification of Psychological States for Real-Time Monitoring During Manned Submersible Missions

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ABSTRACT

Operations by human personnel on manned submersibles are challenging due to confined high pressured hazardous environment that restricts physical movement and personal space. These result in physical and psychological discomforts such as fatigue, fear, anxiety etc., due to the inherently demanding conditions. To mitigate these issues, comprehensive training, strict safety protocols, and targeted support are crucial. Researchers have tried to identify the psychological stressors for personal in manned submersibles and identify coping mechanisms in case of emergencies. AI algorithms are developed to identify physical and psychological states such as fear and anxiety from the behavioral and physiological measures. Behavioral data is prone to social factors and may not reveal the true

underlying state and hence physiological data is a more reliable measure for identifying such conditions. Among various physiological signals, ECG is non-intrusive and easily obtained using wearable devices. This article focusses on processing the ECG signals for identification of the psychological state of divers in submersibles. ECG data is collected in a simulated confined environment, pre-processed using filtering techniques such as bandpass filtering (0.5–40 Hz), Discrete Wavelet Transform (DWT) for baseline wander removal, and lowpass filtering (35 Hz) to reduce high-frequency noise. Features such as time-domain (mean, standard deviation, RMS), frequency-domain (Power Spectral Density), and non-linear measures (entropy, kurtosis, and skewness) are extracted and analysed to distinguish psychological states.

Ke

ywords: Psychological measures, Fear, Fatigue, Physiological signals

Adaptive Multi-Band Implantable Antenna for Smart Biomedical Telemetry

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ABSTRACT

Reliable wireless communication is essential for modern implantable medical devices used in continuous health monitoring and diagnosis. Conventional implantable antennas usually operate at a single fixed frequency, which can limit communication performance when body tissues or surrounding conditions change. To overcome this limitation, a compact frequency-reconfigurable implantable antenna is proposed for smart biomedical telemetry applications. The antenna is designed to switch between multiple operating bands such as MedRadio (402–405 MHz), 915 MHz, and 2.45 GHz, allowing both low-power data transmission and higher data-rate communication when needed. A miniaturized radiator structure with integrated switching elements is used to modify the effective current path and maintain stable impedance matching under tissue-induced detuning conditions. A biocompatible protective layer is considered for safe long-term implantation, while low specific absorption rate (SAR) is targeted to reduce energy absorption in surrounding tissues. The proposed design can also adaptively select the most suitable operating frequency based on signal quality or environmental variations inside the body. This improves communication reliability during patient movement or changes in tissue properties. Simulation studies using multilayer human tissue models are expected to demonstrate stable resonance characteristics, flexible multi-band operation, and improved link performance compared with conventional single-band implantable antennas. With compact size, adaptive frequency switching, and reliable in-body communication capability, the proposed antenna can be a promising solution for future medical implants such as cardiac monitors, glucose sensors, neurostimulators, and capsule diagnostic devices.

Keywords: implantable antenna, wearable device, multi-band, SAR

Classification of Mangrove Ecosystem and Prediction by mapping the drone-based imagery using machine learning techniques

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ABSTRACT

The mangrove species often grow in close proximity, leading to mixed pixels in remote sensing data. However, none of the existing works concentrated on multiple overlapping species identification in mangrove species classification.Therefore, this paper introduces mixed pixel-based mangrove species classification using the GP-CMM andSLC-tDNN approaches. Initially, the drone images are collected and then pre-processed through radiometric correction, color correction, shadow removal, and contrast enhancement. From the pre-processed image, mosaicking is performed, and 3D construction of the mosaic images is created. From the mosaicked image, a topography map is constructed. On the other hand, the mosaicked image undergoes gradient blending using CGCLP. Next, by using GP-CMM, spectral unmixing is performed on the outcome of gradient blending. After that, from the outcome of spectral unmixing, the distinct regions are segmented using SNWHS. Further, derivative analysis is carried out using RRFSD from the segmented image. Next, features are extracted from a constructed topography map, distinct region segmentation, and derivative analysis. After that, the species classification is performed by using SLC-tDNN from the extracted features. Finally, the classified species are mapped using STFM-KMC. The overall performance of the proposed model is analyzed by collecting the images from the Coringa Mangroves across a vast area of approximately 150 acres in the Kakinada district of Andhra Pradesh. A total of 1834 images of the Coringa Mangroves are captured using drone-based imaging. According to the experimental analysis, the proposed model achieved an accuracy of 98.33% and a precision of 98.32%.

Keywords: Mangrove Species, Contextual Gradient Clipped Laplacian Pyramid (CGCLP), Gaussian Penalty on Coefficient Variability Mixture Model (GP-CMM), Spatial Neighborhood Watershed Histogram Segmentation (SNWHS), Spatial-Temporal Frequency Mapped K-Means Clustering (STFM-KMC), Student's Log Convolutional t-Distribution Neural Network (SLC-tDNN), and Intensity Thresholding Poisson Equation (ITPE).

Medicine Recommendation System Using (NLP&GPT) AI

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ABSTRACT

The rapid digitization of healthcare has increased the need for intelligent systems that deliver reliable and accessible medical guidance. This study presents an AI-driven Medicine Recommendation and Information System designed to support informed healthcare decisions, particularly for individuals without immediate access to medical professionals. The recommendation engine uses a structured dataset of medicines and related symptoms. Data preprocessing techniques—such as text normalization, tokenization, stop word removal, and lemmatization—ensure consistent representation. The processed data is converted into numerical form using TF-IDF and Count Vectorizer methods. A

cosine similarity matrix then compares user-input symptoms with stored medicine profiles and ranks medicines based on relevance. The system also includes a conversational AI module that allows users to ask questions about dosage, usage, side effects, precautions, storage, and drug interactions. Through intent recognition and a structured knowledge base, it provides clear and context-aware responses. With a two-phase architecture consisting of offline processing and real-time deployment, the system ensures efficiency, scalability, and improved digital healthcare support.