



10th International Electrical Engineering Conference

Friday 29th & Saturday 30th August, 2025

Theme:

Transforming Horizons in Electrical Engineering – (THRIVE)

Organized By:

Institute of Engineers Pakistan & NED University of Engineering & Technology

Harnessing Artificial Intelligence for Next-Generation Electrical Infrastructure

Dilbar Hussain^{1*}, Dr. Dure Jabeen¹, Faiza Latif Abbas¹, Ghalib Nadeem²

Artificial intelligence (AI) becomes a conversion device in the rapidly evolving field of electrical engineering, improving decision-making, optimizing energy systems, and improving operational efficiency. AI control technology has improved production, error detection, prediction and real-time network management. This study examines how AI control technologies can focus on automation, error detection and smart grid optimization, which can improve performance, reliability and efficiency electrical materials. Studies on machine learning(ML), deep learning(DL), and increasing enrichment examines the use of AI in electrical engineering. Using case studies and simulations, this paper evaluates the effectiveness of AI in electricity systems with a focus on intelligent grid management and forecasting. Surgical intelligent grid case studies, power supply error drive applications, and real- time AI model simulations for electrical engineering problems are all included in the research method. This allows for thorough testing to implement opportunities in ways that AI can improve system performance and save operational costs. This study is unusual because it combines the challenges of electrical systems with the highly developed skills of AI. The aim of study to denote how AI electrical engineering systems can be evaluated for effectiveness and supported by dealing with more automated, more reliable and efficient infrastructure. Energy management, system efficiency, and accurate problem diagnosis prove that AI technology improves enhancement, especially in electrical engineering. By improving network management, reducing downtime and increasing efficiency, AI-powered techniques pave the way for more durable and smarter electrical systems.

Analyze the Deep Learning Algorithms for Image Enhancement

Faiza Latif Abbas^{1*}, Dilbar Hussain¹, Dr. Dure Jabeen¹, Ghalib Nadeem²

Image reconstruction is key in Deep Learning(DL) with applications in surveillance, medical imaging, and image enhancement. To further increase accuracy and efficiency in image reconstruction, this work presents a novel deep learning-based approach utilizing Densenet121 and a 27-layer convolutional neural network(CNN) to fine needs where DenseNet121 will complement the CNN model for image reconstruction. In this work, the algorithm was refined and then trained on one large dataset referred to as Deep Autoencoder Image Reconstruction to check its performance. The efficiency of the proposed method was evaluated by studying major performance metrics F1-score, recall, accuracy, and precision among many others. It achieved an F1-score of 90.3%, recall of 91%, precision of 92.3%, and accuracy of 94.6%, better in terms of reconstruction capability compared to traditional methods. This work shows how to help future growth in the field and also shows how DL algorithms can make images come back very clearly.

Paper ID: IEEC-2025_paper_17	
------------------------------	--

Cyber Resilient Asset Lifecycle Management: A Unified Approach for Operational Technology

Muhammad Rafi Mushtaq¹, Waqar Ahmad Sohail²

Operational Technology (OT) environments face an increasing challenge in managing cybersecurity risks while maintaining asset performance, operational safety, and resilience. Existing frameworks, such as ISA/IEC 62443, ISO 55001, and NIST CSF, provide critical guidance but are often applied in isolation, leading to fragmented workflows and inefficiencies. This paper introduces the Cyber Resilient Asset Lifecycle Management (CRALM) framework, which unifies cybersecurity, process safety management (PSM), and asset management processes. CRALM integrates key aspects of these frameworks into a cohesive, lifecycle-centric approach, emphasizing value delivery, risk management, governance, operational safety, and resilience.

Paper ID: IEEC-2025_paper_27	
------------------------------	--

Design Analysis and Performance Evaluation Of 400 Watts DAB Converter

Syeda Ayesha Tirmizi¹, Humna Asad², Aiman Najeeb³, Hafsa Zaveri⁴, Ammar Amir⁵

As power electronics technology advances, converter designs have become increasingly complex to pursue maximum efficiency. While these sophisticated solutions offer high performance, they often involve costly hardware, advanced control techniques, and increased implementation difficulty. In this paper, we present a simple yet optimized design of a 400-watt Dual Active Bridge (DAB) converter tailored for low to medium voltage applications. The proposed system uses Single Phase Shift (SPS) modulation and a bootstrap gate driver circuit based on the IR2110, controlled by an ESP32 microcontroller. This approach emphasizes ease of implementation, cost-effectiveness, and digital integration, without compromising performance. Key design parameters of the system are derived analytically, and the system is verified through simulation and hardware testing. A custom 4-layer PCB was developed to ensure compactness and thermal efficiency. Experimental results confirm proper operation and proportional output response under varying input voltages. With a measured efficiency of up to 95%, the proposed design achieves high performance while avoiding the complexities found in modern high-end converter systems. This work provides a practical, accessible solution for medium-power applications.

Paper ID: IEEC-2025_paper_32	
------------------------------	--

Comparative Analysis of Single-Axis and Dual-Axis Solar Tracking

R.M Larik, U. Siddiqui, A. Khurram, A. Gudaro, Z. Khan

As the demand for renewable energy grows, maximizing the efficiency of photovoltaic (PV) systems has become crucial. Solar tracking technologies, particularly single-axis and dual-axis systems, play a key role in enhancing energy yield. This study presents a comparative analysis of these two systems in terms of energy efficiency, cost-effectiveness, and real-world applicability. Dual-axis trackers offer higher energy gains by following the sun's movement in both azimuth and elevation, but come with increased costs and complexity. Single-axis trackers, while less efficient, provide a simpler and more economical solution suitable for larger-scale or budget-conscious installations. The analysis considers factors such as installation and maintenance costs, return on investment, and suitability across different environments. The findings suggest that although dual-axis systems outperform in terms of energy capture, single-axis systems may offer a better trade-off between performance and affordability for many practical scenarios.

Design and Development of an IoT-based Fire Alarm System

Sana Ali Bachani¹, Noor Nabi Shaikh¹, Moiz Amin¹, Zakaullah Kaimkhani¹, Dr.Nayyar Hussain Mirjat¹

Fire incidents in Pakistan are increasing rapidly, demonstrating the need for reliable and smart fire detection systems. Pakistan's national fire safety challenges persist because of an outdated framework and technique, though international safety standards exist. This research examines frequent fire occurrences and their harmful effects across the country, highlighting the aim of our research. The proposed system incorporates LM75 temperature, MQ2 smoke, and IR flame sensors to establish a reliable fire alarm system. An IoT framework integrates the sensors for transmitting real-time data to the Blynk IoT, which offers remote control and monitoring functions. The system activates alerts through in-app notifications and emails alerting the authorized personnel about detected fire situations. The ESP-WROOM-32 microcontroller facilitates Wi-Fi communication. The system triggers the buzzer and Blynk server alerts whenever the sensor values exceed the predefined thresholds, indicating smoke or fire. The programmed response time is 3 seconds while the buzzer lasts for 1 to 5 minutes, allowing rapid fire prevention.