

Editorial

Engineering intelligence for sustainable and secure digital futures

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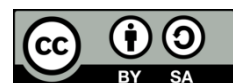
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ABSTRACT

This editorial introduces Volume 41, Number 2 (February 2026) of the Indonesian Journal of Electrical Engineering and Computer Science (IJECS), which presents a diverse collection of peer-reviewed articles reflecting recent advances in electrical engineering, electronics, and computer science. The issue highlights the convergence of power and energy systems, artificial intelligence, cybersecurity, the Internet of Things (IoT), and data-driven engineering methodologies in addressing contemporary technological and societal challenges, with key contributions focusing on renewable energy integration, intelligent control strategies, secure and trusted digital infrastructures, smart IoT-based systems, and AI-driven applications in healthcare, finance, industrial automation, and human-centered computing. Particular emphasis is placed on energy efficiency, system resilience, explainable and trustworthy artificial intelligence, and sustainable engineering practices. Collectively, the published works demonstrate how interdisciplinary research can bridge theory and real-world implementation while supporting the United Nations Sustainable Development Goals, including affordable and clean energy, good health and well-being, sustainable cities, responsible consumption, and strong digital institutions. By fostering innovation, cross-domain collaboration, and responsible technology development, this issue of IJECS aims to advance secure, intelligent, and sustainable engineering solutions that respond to both current demands and future global challenges. This issue further reinforces the journal's commitment to advancing engineering intelligence that is ethically grounded, environmentally responsible, and resilient by design.

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The Indonesian Journal of Electrical Engineering and Computer Science (IJECS), Volume 41, Number 2, February 2026, presents a comprehensive and diverse collection of peer-reviewed research articles that reflect the rapid evolution and interdisciplinary character of contemporary electrical engineering, electronics, and computer science. This issue brings together theoretical advancements, methodological innovations, and practical applications that collectively respond to the growing demands of digital transformation, sustainability, and intelligent system development.

A unifying theme across this issue is the convergence of advanced power and energy systems, artificial intelligence and machine learning, cybersecurity, the Internet of Things (IoT), and data-driven engineering solutions. The articles published in this issue demonstrate how modern engineering research increasingly transcends disciplinary boundaries to address complex technological and societal challenges.

Power, energy, and intelligent control systems

Several contributions in this issue focus on advances in power electronics, renewable energy integration, and intelligent control. Studies on three- and five-level neutral point clamped (NPC) inverters

utilizing active disturbance rejection control (ADRC) and modified ADRC (MADRC) report improved stability, robustness, and dynamic performance in photovoltaic grid-connected systems, supporting enhanced power quality and operational reliability under varying environmental and load conditions. These works address key challenges associated with the intermittency and variability of renewable energy sources and demonstrate the role of advanced control strategies in enabling higher renewable penetration.

These contributions are complemented by research on synthetic inertia controllers for wind power plants, which address grid frequency stability and system resilience in low-inertia power systems with high shares of converter-interfaced generation. In addition, the development of an educational SCADA training kit for electric railway systems highlights practical innovations in power system monitoring and control, supporting hands-on learning, supervisory control, and real-time fault management. Together, these studies illustrate how integrated advances in power electronics, intelligent control, and system-level monitoring can strengthen the reliability, flexibility, and sustainability of modern energy infrastructures.

IoT, smart systems, and sustainable engineering applications

IoT-based solutions represent a major pillar of this issue, reflecting their expanding role in smart environments and cyber-physical systems. Research on smart home automation, IoT-enabled connected incubators for neonatal monitoring, and hybrid edge–cloud computing frameworks for smart city applications illustrates how intelligent connectivity can enhance service quality, real-time responsiveness, and overall system resilience. These studies demonstrate how distributed sensing, edge intelligence, and cloud-based analytics can be integrated to support scalable and adaptive smart system architectures.

In parallel, sustainability and efficiency are addressed through studies on low-power circuit design for medical and embedded applications, energy-efficient secure routing in IoT networks, and optimization of temporary waste disposal sites using mathematical programming models. These contributions highlight the importance of co-designing hardware, communication protocols, and optimization strategies to reduce energy consumption while maintaining system performance and security. Collectively, the published works illustrate how IoT-driven and data-informed engineering solutions can support environmentally responsible, resource-efficient, and socially beneficial smart infrastructures.

Cybersecurity, cryptography, and trusted digital infrastructure

As digitalization accelerates across critical sectors, ensuring secure and trustworthy systems has become a central concern. This issue includes a broad range of studies on cryptographic architectures, hybrid encryption schemes, and intelligent cybersecurity frameworks for real-time threat detection and data protection. These contributions highlight the importance of integrating security-by-design principles into modern digital platforms, enabling confidentiality, integrity, and availability across heterogeneous and distributed environments.

Further studies on botnet detection using machine learning, security assessment-as-a-service models, and trusted remote attestation frameworks with zero-trust architecture for industrial IoT environments emphasize proactive and scalable approaches to cybersecurity. By leveraging data-driven threat intelligence, continuous monitoring, and adaptive trust mechanisms, these works address the evolving complexity of cyber threats in interconnected systems. Collectively, the contributions underscore the need for intelligent, automated, and resilient security strategies to protect critical digital infrastructure, support regulatory compliance, and strengthen trust in next-generation cyber-physical and industrial systems.

Artificial intelligence and machine learning across domains

Artificial intelligence and machine learning constitute a dominant theme in this issue, with applications spanning healthcare, finance, industrial systems, and human-centered computing. Several studies explore deep learning, reinforcement learning, explainable AI, and hybrid AI models to address complex, high-dimensional problems, highlighting the growing importance of data-driven intelligence in supporting decision-making and automation. These contributions illustrate how advanced learning paradigms can enhance system adaptability, interpretability, and performance across diverse application contexts.

Notable studies include human gait analysis using explainable deep reinforcement learning, hybrid SVM–ANN systems for automated MRI diagnosis, and machine learning approaches for predicting chronic kidney disease and Parkinson’s disease, demonstrating the role of AI in improving diagnostic accuracy and clinical decision support. In financial and socioeconomic domains, research on fraud detection, customer churn prediction, non-performing loan forecasting using deep Q-learning, and propensity score estimation in high-dimensional data further illustrates the expanding impact of AI-driven analytics. Collectively, these works underscore the transformative potential of trustworthy and explainable AI to enhance efficiency, reliability, and human-centered outcomes across multiple sectors.

Computer vision, signal processing, and multimedia systems

Advances in computer vision and signal processing are prominently featured in this issue, reflecting their expanding role in intelligent perception, secure authentication, and immersive digital systems. Studies on text localization in natural scene images, depth estimation for handheld augmented reality, palmprint biometric authentication, and facial expression analysis for academic engagement monitoring demonstrate how visual and signal-based intelligence can enhance human–computer interaction, situational awareness, and user-centered system design. These contributions highlight the increasing integration of perception technologies into everyday and professional digital environments.

In addition, research on virtual tour navigation systems for cultural tourism illustrates how multimedia and intelligent systems can contribute to digital heritage preservation and enhanced user experiences. By combining computer vision, interactive media, and intelligent navigation, such systems support broader access to cultural assets while enabling more engaging and personalized digital interactions. Collectively, these works emphasize the role of vision and signal processing technologies in enabling secure, immersive, and human-centered digital services across education, tourism, and smart environment applications.

Networking, localization, and industrial intelligence

This issue also addresses foundational challenges in networking, localization, and industrial systems that are critical to the performance and scalability of modern digital infrastructures. Contributions on improving DVHOP localization algorithms in wireless sensor networks, networking protocols for electric mobility, and robust communication strategies for IoT systems provide insights into enhancing accuracy, reliability, and efficiency in distributed and resource-constrained environments. These studies highlight the importance of adaptive networking and localization techniques in supporting real-time and mission-critical applications.

In addition, research on semiconductor manufacturing defect detection and AI-enhanced predictive maintenance demonstrates the growing role of data analytics and intelligent monitoring in improving industrial productivity and quality assurance. By integrating machine learning with industrial sensing and process data, these approaches enable early fault detection, reduced downtime, and optimized maintenance strategies. Collectively, these contributions underscore how advances in networking, localization, and industrial intelligence can strengthen operational resilience, support digital transformation in manufacturing, and enhance the efficiency and competitiveness of industrial systems.

Conclusion and SDG-Oriented Outlook

The research presented in this issue underscores the increasingly strategic role of engineering and computer science in advancing the United Nations Sustainable Development Goals (SDGs). The contributions directly and indirectly support SDG 7 (Affordable and Clean Energy) and SDG 9 (Industry, Innovation, and Infrastructure) through innovations in renewable energy systems, intelligent control, power electronics, and industrial automation. Equally important are studies aligned with SDG 3 (Good Health and Well-Being), where artificial intelligence, IoT, and signal processing are leveraged to enhance medical diagnostics, patient monitoring, and healthcare decision-making. Research on cybersecurity, trusted systems, and data protection further contributes to SDG 16 (Peace, Justice, and Strong Institutions) by strengthening the resilience, integrity, and trustworthiness of digital ecosystems. In addition, works addressing smart cities, waste management optimization, and energy-efficient IoT systems support SDG 11 (Sustainable Cities and Communities) and SDG 12 (Responsible Consumption and Production). Collectively, these contributions demonstrate how responsible and interdisciplinary engineering research can generate measurable societal and environmental impact.

Looking ahead, IJEECS remains committed to promoting high-quality research that advances scientific knowledge while contributing to global sustainability objectives. Through continued support for innovation, interdisciplinary collaboration, and responsible technology development, the journal seeks to facilitate engineering solutions that are not only technically rigorous but also socially relevant and environmentally sustainable. In this context, emphasis is placed on research that integrates sustainability, security, and ethical considerations as core design principles, rather than as secondary concerns. By encouraging contributions that address long-term system resilience, transparency, and responsible use of data and artificial intelligence, IJEECS aims to support the development of digital and engineering systems that foster public trust and deliver lasting societal value in an increasingly complex and interconnected global landscape.