

PREFACE TO THE EDITION

It is our pleasure to present the latest issue of the **International Journal of Technical Research Studies (IJTRS)**, a scholarly platform dedicated to disseminating innovative research and technological advancements across engineering, applied sciences, and emerging interdisciplinary domains. This issue brings together a collection of high-quality contributions that reflect the transformative impact of digital technologies, intelligent systems, and sustainable engineering solutions in addressing the complex challenges of modern industry and society.

The articles featured in this issue collectively highlight the rapid evolution of Industry 4.0 technologies, artificial intelligence-driven systems, renewable energy integration, and next-generation transportation technologies. Through rigorous research and practical applications, the authors provide valuable insights into how advanced engineering innovations can improve efficiency, reliability, sustainability, and resilience across diverse technical sectors.

The opening article explores the application of digital twin technology for predictive maintenance in smart manufacturing systems. By integrating real-time condition monitoring, cloud-native analytics, and hybrid machine-learning models, the study demonstrates how intelligent maintenance frameworks can significantly reduce equipment downtime and operational costs while enhancing overall equipment effectiveness. The research exemplifies the growing role of cyber-physical systems in industrial transformation.

The second contribution examines edge-AI-enabled structural health monitoring of civil infrastructure. Addressing the challenges of latency, bandwidth consumption, and scalability, the study presents an innovative edge–fog–cloud architecture that enables real-time damage detection and localization directly at sensor nodes. The findings highlight the potential of distributed intelligence to improve the safety, reliability, and economic viability of large-scale infrastructure monitoring systems.

Energy sustainability forms a major theme of this issue through two significant contributions. The third article investigates grid-forming inverter control strategies for renewable-dominated power systems, addressing one of the most critical challenges associated with the global transition toward renewable energy. Through comparative analysis of advanced inverter-control methodologies, the study provides practical guidance for maintaining power-system stability in low-inertia electricity networks.

Complementing this perspective, the fourth article focuses on green hydrogen production through proton-exchange-membrane water electrolysis. The study offers a comprehensive evaluation of electrolysis technologies and identifies the key technical and economic factors influencing hydrogen competitiveness. Its findings contribute to ongoing efforts toward achieving large-scale decarbonization and establishing hydrogen as a viable clean-energy carrier for the future.

The final article addresses the increasingly important field of electric vehicle battery thermal management. Through a comparative analysis of multiple cooling architectures, the study presents valuable design insights for improving battery safety, performance, and longevity. As electric mobility continues to expand globally, efficient thermal management remains a crucial factor in advancing reliable and sustainable transportation systems.

Together, the contributions in this issue demonstrate how cutting-edge research is accelerating technological progress across manufacturing, infrastructure, energy, and transportation domains. They reflect the growing integration of artificial intelligence, advanced control systems, computational modeling, and sustainable engineering practices in the development of next-generation technical solutions.

The Editorial Board extends its sincere appreciation to all authors, reviewers, and editorial team members whose dedication and expertise have made this publication possible. Their collective efforts ensure the continued quality and relevance of the journal in promoting impactful technical research and innovation.

We hope that the studies presented in this issue will stimulate further research, inspire technological advancement, and serve as valuable resources for researchers, engineers, academicians, industry professionals, and policymakers. As technology continues to evolve at an unprecedented pace, IJTRS remains committed to fostering scholarly dialogue and supporting innovations that contribute to sustainable and inclusive global development.

Dr. Krishna Prasad K
Chief editor

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