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Cutting-Edge Developments in Engineering and Technology: A Global Perspective

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Abstract

The rapidly evolving landscape of engineering and technology presents both challenges and opportunities for modern societies. From artificial intelligence and renewable energy innovations to advancements in materials science and automation, these developments are reshaping industries and driving global progress. This paper explores cutting-edge developments in engineering and technology from a global perspective, emphasizing the transformative impact on various sectors. The paper also highlights the ways in which different regions are adopting and adapting to these innovations, leading to a more interconnected and technologically advanced world. Finally, we examine the potential future directions and implications of these developments on global sustainability, economic growth, and social change.



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Improved Frequency Stability in Autonomous AC Microgrids through Modified Whale Optimization Algorithm-Based PID Controllers

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Keywords: Micro grid (MG), Proportional-Integrator-Derivative (PID), Integral of squared error (ISE), Modified Whale Optimisation Algorithm (MWOA), Opal-RT, Matlab-2019b

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**Harnessing Artificial Intelligence for Global Sustainability:
A Cross-Sectoral Analysis of Emerging Technologies**

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Abstract

Artificial Intelligence (AI) is reshaping how humanity addresses the complex challenges of global sustainability. From optimizing energy usage and reducing carbon footprints to improving healthcare, education, and agriculture, AI-driven technologies are emerging as pivotal tools for achieving the United Nations Sustainable Development Goals (SDGs). This research paper presents a cross-sectoral analysis of how AI is being integrated across industries to promote sustainability. It critically examines the environmental, social, and economic implications of these technologies, identifies challenges including ethical concerns, data governance, and infrastructural disparities, and proposes policy recommendations for responsible AI adoption. The study underscores the transformative potential of AI while advocating for inclusive, ethical, and collaborative frameworks to ensure that technological advancements serve the broader cause of planetary well-being.

Keywords: Artificial Intelligence, Sustainability, SDGs, Green Technology, Cross-Sectoral Innovation, Ethics, AI Policy, Smart Systems, Climate Change Mitigation, Global Development



**Federated Learning for Privacy-Preserving AI: A
Comparative Analysis of Decentralized Data Training
Approaches**

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Abstract

The rapid adoption of Artificial Intelligence (AI) across industries, particularly in healthcare, finance, and smart devices, has introduced significant concerns regarding data privacy, security, and compliance with regulations such as GDPR, HIPAA, and CCPA. Traditional centralized machine learning (ML) models require large-scale data aggregation, increasing risks of data breaches, misuse, and unauthorized access. Federated Learning (FL) has emerged as a transformative solution, allowing multiple edge devices or organizations to collaboratively train machine learning models without sharing raw data.

This paper explores the principles, advantages, and challenges of FL and conducts an empirical analysis comparing FL's efficacy, security, and scalability to centralized models. A case study on federated learning in healthcare diagnostics highlights the real-world impact of this approach. Additionally, insights from a structured survey of AI researchers, data scientists, and industry professionals are analyzed to assess FL adoption, technical challenges, and future potential.

Findings suggest that FL enhances privacy and compliance, making it particularly suitable for industries handling sensitive information. However, challenges such as high computational costs, model convergence issues, and

**A HIGH-EFFICIENCY SEVEN-LEVEL INVERTER WITH
SELF-BALANCED SWITCHED-CAPACITOR TOPOLOGY
VALIDATED THROUGH PLECS SIMULATION AND
EXPERIMENTAL SETUP**

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