

Renewable Energy Grid Optimization Using Metaheuristic Algorithms in IoT-Based Smart City Frameworks

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Abstract:

The integration of renewable energy sources into smart city infrastructures requires efficient grid management strategies to ensure sustainability and energy reliability. This research presents an IoT-enabled framework for optimizing renewable energy grids using metaheuristic algorithms. Real-time data from solar panels, wind turbines, and energy consumption units are collected via IoT sensors and analyzed to manage energy distribution dynamically. Metaheuristic optimization techniques such as Genetic Algorithms (GA), Particle Swarm Optimization (PSO), and Ant Colony Optimization (ACO) are utilized to address the challenges of load balancing, energy storage, and demand forecasting. These algorithms enhance the operational efficiency and resilience of energy systems by identifying optimal configurations for power allocation and grid stability. The proposed framework demonstrates improved energy utilization and reduced dependency on non-renewable sources, contributing to sustainable smart city development.

Keywords:

Renewable energy, smart city, metaheuristics, IoT, energy grid optimization, sustainable infrastructure.

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