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IoT and Neural Network-Based Optimization for Renewable Energy in Smart Agriculture Applications

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Abstract:

The integration of renewable energy systems in smart agriculture is essential for enhancing sustainability, reducing carbon footprints, and ensuring efficient resource utilization. This study proposes a neural network-based optimization framework, supported by IoT infrastructure, to manage and enhance renewable energy usage in agricultural operations. IoT devices collect real-time data on solar radiation, wind patterns, soil conditions, and energy consumption across farms. Neural networks, including Recurrent Neural Networks (RNNs) and Deep Feedforward Networks, are applied to predict energy demands, optimize load balancing, and control the distribution of solar and wind-generated power. The system dynamically adapts to environmental and operational changes, ensuring uninterrupted and efficient energy supply to critical agricultural systems such as irrigation, monitoring sensors, and autonomous equipment. Experimental simulations reveal substantial improvements in energy efficiency, system reliability, and operational sustainability. This framework supports the development of intelligent, eco-friendly farming practices powered by clean energy.

Keywords:

IoT, neural networks, renewable energy, smart agriculture, energy optimization, sustainable farming.

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