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Water Resource Optimization in Smart Agriculture Through IoT and Machine Learning Techniques

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Abstract:

Water resource management is a critical challenge in agriculture, particularly in regions experiencing water scarcity. This study presents an IoT-based framework integrated with machine learning techniques for optimizing water resource usage in smart agriculture. The system uses IoT sensors to collect real-time data on soil moisture, weather conditions, and crop health, while machine learning algorithms, such as Random Forest, Support Vector Machines (SVM), and Artificial Neural Networks (ANN), analyze the data to predict water requirements and optimize irrigation schedules. By implementing predictive models, the framework enables precision irrigation, ensuring that crops receive the optimal amount of water at the right time, thus reducing water wastage and enhancing crop yield. The results of this study indicate that the integration of IoT and machine learning significantly improves water use efficiency, promotes sustainable agricultural practices, and helps farmers make data-driven decisions for resource management. This approach not only conserves water but also supports the long-term viability of agricultural production in water-constrained environments.

Keywords:

Water resource optimization, smart agriculture, IoT, machine learning, precision irrigation, sustainability.

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