

Decentralized IoT Solution for Smart Agriculture Using LoRaWAN and Edge Computing

Abstract:

Previous smart irrigation systems face limitations such as dependency on third-party cloud services, limited connectivity range, inefficient water usage, and lack of data privacy. These challenges often hinder the effectiveness and scalability of traditional solutions. To address these issues, this project proposes a decentralized smart irrigation system tailored for agricultural fields. Using a master-slave architecture, the Raspberry Pi acts as the master node while multiple ESP32 nodes serve as slave nodes, each equipped with a soil moisture sensor and a sprinkler. With LoRa communication for long-range, low-power connectivity, the slave nodes monitor soil moisture levels every five minutes and send the data to the master node. The master node hosts a private, decentralized web server for real-time monitoring and decision-making, eliminating the need for third-party cloud services. When the soil moisture falls below a certain threshold, the corresponding slave node activates its sprinkler, ensuring precise water usage and shutting it off when the moisture level is restored. This approach improves data privacy, reduces reliance on external cloud platforms, and enhances irrigation efficiency, contributing to sustainable and autonomous farming practices.