Smart Irrigation System

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Abstract

Water shortage is a big problem in farming, especially in states like Maharashtra. Many farmers use too much water because irrigation is not managed properly, which causes water wastage. This paper explains a Smart Irrigation System that uses IoT sensors and Artificial Neural Networks (ANN) to solve this problem.

The system uses sensors to measure soil moisture, temperature, humidity, and rainfall. This data is sent to an ANN model, which decides when and how much water the crops really need. The system then automatically turns irrigation on or off.

Results show that this smart system can save 35–45% of water compared to traditional methods like fixed timers or simple moisture limits, while still keeping crops healthy. Because ANN can learn from data and improve decisions over time, the system is smart, adaptable, and useful for modern precision farming.

Keywords— Smart Irrigation, IoT, Artificial Neural Network, Precision Agriculture, Water Conservation, Automated Irrigation.

Introduction

In India, farming uses about 80% of the available fresh water, but a lot of this water is wasted because of poor irrigation methods. Traditional irrigation systems work on fixed time schedules or simple moisture limits. These systems cannot adjust according to weather changes, soil condition, or crop needs.

This paper introduces a Smart Irrigation System using IoT and Artificial Neural Networks (ANN). The system uses low-cost sensors to collect real-time data such as soil moisture, temperature, humidity, and rainfall. This data is processed using an ANN model, which decides how much water is actually needed.

Unlike simple rule-based systems, ANN learns from past data and improves its decisions over time. This helps to save water, reduce wastage, and increase crop yield.

Future Work

In the future, the system can be improved by using weather forecast data to make smarter irrigation decisions, while machine learning models can predict crop water needs based on soil type and climate conditions. Adding a mobile application and cloud storage will help farmers easily monitor the system and analyze long-term data. The system can also be expanded to support multiple sensors and fields, making it suitable for large-scale agricultural use.

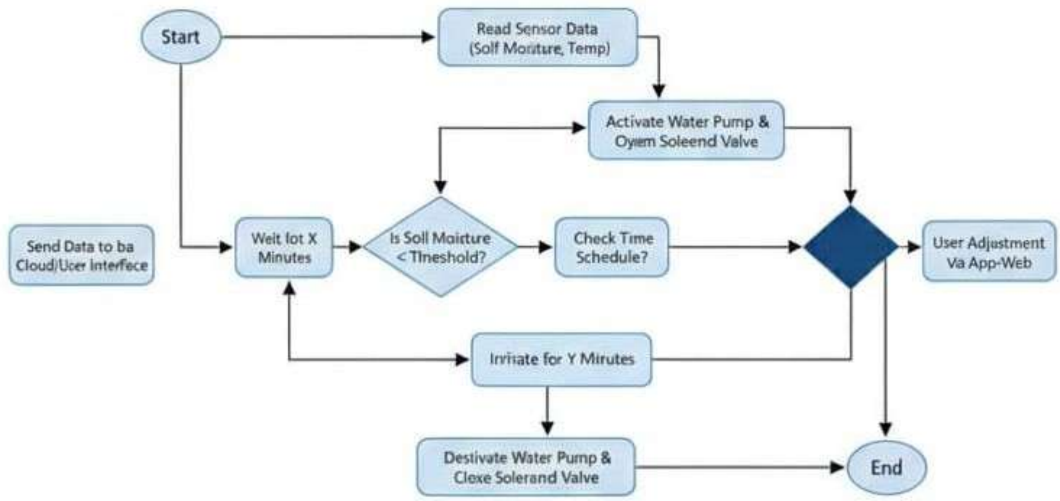
Literature Review

Smart irrigation systems are becoming popular because water is limited and farming needs to be more efficient. Traditional irrigation methods use too much water and need constant human monitoring. To solve this, researchers have developed automatic irrigation systems using IoT, sensors, and machine learning. Many systems use soil moisture sensors to check soil condition and turn water pumps on or off automatically. Some studies also use Arduino or ESP8266 with cloud platforms so farmers can monitor fields using mobile or web apps. Machine learning is used to decide irrigation timing based on past weather and soil data. However, many existing systems are costly, complicated, or difficult to use. This project solves these problems by offering a low-cost, easy-to-use smart irrigation system using Python, Flask, IoT hardware, and a web dashboard for both manual and automatic motor control.

Existing System

The existing smart irrigation system works using fixed rules and human decisions, not artificial intelligence. Farmers manually check soil condition, weather, and crop type to decide when watering is needed. A soil moisture sensor sends data to a microcontroller like Arduino or ESP32. When the moisture level goes below a set limit, the water pump turns ON, and when the soil has enough moisture, the pump turns OFF. Farmers can also control the pump manually. This system is simple and low-cost, but it depends on human experience and cannot automatically adjust to changes in weather or crop requirements.

Architecture Diagram



Result

The smart irrigation system was tested in different soil moisture conditions. When the soil became too dry, the system automatically switched the water motor ON. When enough moisture was reached, the motor was switched OFF, which helped save water. A web dashboard allowed users to see sensor data in real time and control the motor manually if needed. The system worked reliably, responded quickly, and managed water efficiently. Compared to manual irrigation, it reduced human effort and improved water usage.

Conclusion

This project successfully shows how an IoT-based smart irrigation system can be built using Python and Flask. The system allows both automatic and manual control of irrigation through a simple web interface, making it useful for small farms and learning purposes. By using soil moisture data, it supplies water only when needed, which helps save water and reduce wastage. The system is low-cost, easy to use, and can be expanded, and it clearly shows how IoT and software technologies can work together to solve real farming problems.

Reference

- R. Kumar and M. Singh, "IoT-Based Smart Irrigation System," *International Journal of Advanced Research in Computer Engineering*, vol. 9, no. 3, pp. 45–50, 2022.
- S. Patel et al., "Automated Irrigation System Using Soil Moisture Sensor," *IEEE Conference on Smart Technologies*, pp. 112–116, 2021.
- W3Schools, "Python Machine Learning Tutorial,"[Online]. Available: https://www.w3schools.com
- Flask Documentation, "Flask Web Framework," [Online]. ESP8266 Technical Reference Manual, Espressif Systems.