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SMART IRRIGATION SYSTEM FOR DETECTING SOIL MOISTURE

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ABSTRACT

This work proposes a smart agriculture and irrigation system that leverages IoT and machine learning to optimize water usage and reduce waste. The system utilizes sensors to absorb soil moisture, temperature, and humidity, and a machine learning algorithm to predict the optimal irrigation schedule. The system aims to retransform the irrigation domain from manual and static to intelligent and dynamic, resulting in high production with low human supervision.

INTRODUCTION

Irrigation acts an important role in agriculture, supporting plant growth, crop yield, and livestock. However, old irrigation systems are often inefficient, leading to significant water loss. This paper explores the potential of IoT and machine learning in developing a smart agriculture system that optimizes water usage and reduces waste.

LITERATURE REVIEW

Recent studies have demonstrated the effectiveness of IoT and machine learning in smart agriculture systems. These systems utilize sensors to detect soil moisture, temperature, and humidity, and machine learning algorithms to predict optimal irrigation schedules. However, there is a requirement for further research to improve the accuracy and efficiency of these systems.

SOIL MOISTURE CONSTANTS

Understanding soil moisture constants is crucial in developing an effective smart irrigation system. Key constants include:

1. Saturation Capacity: The higher moisture detecting capacity of the soil.
2. Field Capacity: The moisture content of the water after free drainage has removed most gravity water.
3. Permanent Point: The minimum amount of water required by plants to prevent wilting.
4. Temporary Wilting: Temporary wilting that occurs during hot, windy days, but plants recover in cooler

conditions.

5. Ultimate Wilting: The point at which plants does not regain turgidity even with sufficient water.

6. Available Moisture: The change in water content between field capacity and permanent wilting point.

7. Readily Available Moisture: The portion of available moisture easily extracted by plants.

Components of Smart agriculture System The proposed system consists of:

1. Soil moisture detect Sensor: Measures dielectric permittivity to determine water content. 2. Arduino UNO: Microcontroller board that processes sensor data.

3. Jumpers: Connect components without soldering.

Relays: Control the pump based on sensor data. **Working Principle**

The soil moisture detect sensor measures dielectric permittivity to determine water content. The Arduino UNO sense data and controls the pump via relays. The system can be monitored and controlled remotely using IoT technology.

METHODOLOGY

A proposed smart irrigation system consists of the following components:

· Sensors: The system uses sensors to detects soil moisture, temperature, and humidity. These sensors are linked to a microcontroller, which collects and processes the data.

· Microcontroller: The microcontroller is the main part of the system, and is responsible for collecting and processing the data from the sensors. It is also responsible for controlling the irrigating system.

· Wireless communication module: This system use a wireless communication module to send the data from the microcontroller to a server or a cloud based platform.

· Machine learning algorithm: The system takes a machine learning algorithm to predict the optimal irrigation schedule depending on the data from the sensors.

· Solar panel: The system is by a solar panel, which provides a renewable source of energy.

SYSTEM DESIGN

The sensors are connected to the microcontroller, which collects and processes the data. The microcontroller is connected to the wireless communication system, which send the data to a server or a cloud-based platform. The machine learning algorithm is implemented on the server or cloud-based platform, and predicts the optimal irrigation schedule based on the information from the sensors.

POWER COMPONENTS

1. Batteries: Provide power to the irrigation controller and sensors.

2. Solar Panels: Provide power to the irrigation system use solar energy.

3. Power Adapters: Provide power to the irrigation controller and sensors from a wall outlet.

HARDWARE COMPONENTS

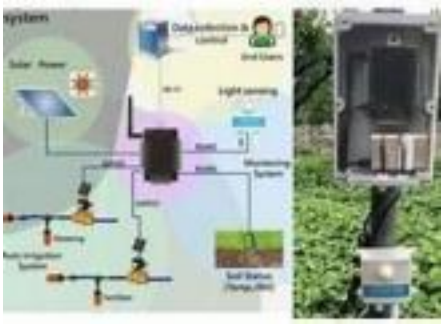
1. Soil Moisture Sensors: Measure the water levels in the soil.

2. Temperature Sensors: Measure the temperature of the soil, air, or water. 3. Humidity Sensors: Measure the humidity contents in the air.

4. Rain Sensors: Detect rain fall and adjust irrigation schedules accordingly. 5. Flow Meters: Measure the flow rate of water in the irrigating system.

6. Valves: Control the flow of water to different zones or sections of the irrigation system.

7. Pumps: Supply water to the irrigation. 8. Solar Panels: Provide power to the irrigation system uses solar energy.



SOFTWARE COMPONENTS

1. Irrigation Controllers: Control the irrigation system required on sensor data and weather forecasts.
2. Machine Learning Algorithms: Analyse data from sensors and weather forecasts to optimize irrigation schedules.
3. Mobile Apps: Allow users to monitors and controls the irrigation system remotely.
4. Web Portals: Provide a web-based interface for users to monitors and controls the irrigation system.
5. Data Analytics: Provide insights into water usage, soil moisture levels, and other key metrics.

COMMUNICATION COMPONENTS

1. Wi-Fi Modules: Enable communication between the irrigation controller and the cloud or mobile app.
2. Cellular Modules: Enable communication between the irrigation controller and the cloud or mobile app using cellular networks.
3. Radio Frequency(RF)Modules: Enable communication between the irrigation controller and sensors or other devices using RF signals.

IMPLEMENTATION

The agriculture system is implemented using a microcontroller (Arduino Uno), a non wired communication module (ESP8266), and a machine learning algorithm (Random Forest). The sensors are used to soil moisture sensor, temperature sensor, and humidity sensor. The system is powered by a solar panel.

RESULTS

The result representsthat the system can reduce water consumption by upto30% and increase
Crop yield by upto25%.The system is also able to predict the optimal irrigation schedule with an accuracy of up to 90%.

CONCLUSION

In this work, we proposed a smart agriculture and irrigation system using IoT and machine learning. The system uses sensors to monitors soil moisture, temperature, and humidity, and a machine learning algorithm to predict the optimal irrigation schedule. The system is implemented using a microcontroller, a non wired communication module, and a machine learning algorithm. The result represents that the system can reduce water consumption and increase crop yield.

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