

AUTOMATIC AGRICULTURE WEATHER STATION MONITORING WITH SMART FARMING USING IOT TECHNOLOGY

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Abstract

The IoT-based Smart Irrigation and Automatic Weather Monitoring System is designed to improve water management and support smart farming using modern technology. This project uses an Arduino Uno microcontroller to collect data from different sensors such as a Soil Moisture Sensor, Rain Sensor, and DHT11 Temperature and Humidity Sensor. These sensors continuously monitor environmental and soil conditions in agricultural fields.

The collected data is processed by the Arduino, which automatically controls a water pump through a relay module when the soil moisture level falls below a predefined value. An LCD displays shows real-time information such as soil moisture, temperature, humidity, and rainfall status. Additionally, a Bluetooth module (HC-05) is used to transmit data to a mobile device for remote monitoring.

This system helps farmers reduce water wastage, improve crop productivity, and automate irrigation without constant human supervision. The project demonstrates how Internet of Things (IoT) technology can be applied in agriculture to create an efficient, cost-effective, and intelligent irrigation system for modern farming.

Keywords: DHT11 temperature and humidity sensor, Bluetooth module, IOT technology.

INTRODUCTION

In earlier times, irrigation was done manually by farmers using traditional methods such as canals, wells, and manual watering. These methods required continuous human effort and often resulted in inefficient water usage. Farmers had to regularly check soil conditions and operate pumps manually, which consumed time and labor.

With the advancement of electronics and embedded systems, automated irrigation systems were introduced. Early automation systems used timers to control irrigation, but they were not intelligent enough to adjust watering based on environmental conditions.

Later, the introduction of microcontrollers and sensors revolutionized irrigation technology. Sensors like soil moisture sensors, temperature sensors, and rain sensors enabled systems to monitor real-time environmental conditions. Microcontrollers such as Arduino made it easier to develop cost-effective smart irrigation systems. Today, smart agriculture systems use technologies like IoT, wireless communication, and cloud monitoring to improve irrigation efficiency. These systems help in water conservation, increase crop productivity, and reduce the workload on farmers.

1. DEFINITION

Automatic Agriculture Weather Station Monitoring using IoT is a smart system that uses sensors and internet-connected devices to collect real-time environmental data (like temperature, humidity, soil moisture, rainfall, etc.) and send it to farmers through mobile or web applications.

It is based on the concept of Internet of Things, where physical devices communicate and share data automatically without human intervention.

2. PURPOSE

Real-time Monitoring – To continuously monitor farm conditions like weather and soil.

Efficient Water Usage – Helps in smart irrigation based on soil moisture levels.

Better Decision Making – Farmers can take accurate decisions using data.

Weather Prediction Support – Helps reduce crop damage from unexpected weather.

Automation – Reduces manual work and saves time.

Increase Crop Yield – Improves productivity and quality of crops.

3. METHODOLOGY

The smart irrigation system is designed using an Arduino Uno as the main control unit, which is connected to various sensors and components to automate the irrigation process. The system includes a soil moisture sensor, rain sensor, DHT11 temperature and humidity sensor, relay module, water pump, Bluetooth module (HC-05), LCD display, and a 18650 lithium-ion battery for power supply. These components work together to monitor environmental conditions and control water flow efficiently.

The sensors continuously collect real-time data from the environment. The soil moisture sensor measures the water content in the soil, the rain sensor detects rainfall, and the DHT11 sensor records temperature and humidity levels. This data is sent to the Arduino Uno, where it is processed according to predefined conditions programmed into the system.

Based on the processed data, the Arduino makes decisions to control the irrigation process. If the soil moisture level falls below a set threshold, the system activates the water pump through the relay module to supply water to the plants. However, if sufficient moisture is detected or rainfall is present, the system automatically turns off the pump to prevent overwatering. The LCD display shows real-time system status and sensor readings, while the Bluetooth module allows wireless monitoring and control through a mobile device.

Overall, this methodology ensures efficient water usage by automating irrigation based on real-time environmental conditions, reducing manual effort and conserving water resources.

4. NEED OF STUDY

The need for studying and developing a smart irrigation system arises due to the increasing demand for efficient water management in agriculture. Traditional irrigation methods often lead to excessive water usage, uneven distribution, and dependency on manual operation, which results in water wastage and reduced crop productivity. In regions where water resources are limited, it becomes essential to use water wisely and only when required.

This project helps in understanding how modern technology such as sensors and microcontrollers can be used to automate irrigation. By monitoring soil moisture, temperature, humidity, and rainfall, the system ensures that crops receive the right amount of water at the right time. This not only conserves water but also improves plant growth and yield.

Additionally, the study of this system provides practical knowledge of embedded systems, IoT concepts, and real-time data processing. It also reduces human effort and minimizes errors caused by manual irrigation. The integration of a Bluetooth module enables remote monitoring and control, making the system more convenient and user-friendly.

Overall, this project is important for promoting smart farming techniques, saving water resources, increasing agricultural efficiency, and encouraging the use of automation in modern agriculture.

5. OBJECTIVES

The main objective of this project is to design and implement an automatic irrigation system using Arduino and sensors that can monitor environmental conditions and control water supply efficiently.

The specific objectives of this project are:

- To monitor soil moisture levels using a soil moisture sensor.
- To detect rainfall using a rain sensor to avoid unnecessary irrigation.
- To measure temperature and humidity using the DHT11 sensor.
- To automatically control the water pump using a relay module.
- To display real-time environmental data on an LCD display.
- To allow wireless monitoring and control through a Bluetooth module
 - To conserve water and reduce manual irrigation efforts.

This system ensures that crops receive the required amount of water at the right time, improving water management and agricultural productivity.

5. SCOPE OF STUDY

The scope of this project is focused on developing a low-cost smart irrigation system that can automatically monitor environmental conditions and control irrigation.

This system can be used in:

- Small farms
- Gardens
- Greenhouses
- Home gardening
- Agricultural research projects

The project demonstrates how sensors and microcontrollers can be integrated to create an automated irrigation solution. The system can be further expanded by integrating IoT technology, allowing remote monitoring through mobile applications or cloud platforms.

Future improvements may include:

- Wi-Fi based monitoring
- Mobile application control
- Solar-powered irrigation system
- Advanced soil analysis sensors

This project provides a foundation for developing more advanced smart agriculture systems.

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