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Agricultural Field Monitoring and Controlling of Drip Irrigation using IOT

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ABSTRACT

In India, agriculture is crucial to the growth of the food industry. Agriculture in our nation is reliant on the monsoons, which are an insufficient source of water. In the agricultural sector, irrigation is employed. The Internet of Things (IoT) represents a turning point in technological development. IOT is crucial in many industries, including agriculture, which has the potential to feed billions of people in the future. The goal of this study is to address this difficulty. Since the entire system is microcontroller based and wirelessly programmable so there is no need to worry about timing irrigation according to crop or soil conditions. Sensors are used to measure soil properties such as soil moisture, temperature, and air moisture. The user (farmer) controls decision-making by utilizing a microcontroller. Wireless transmission is used to transfer the sensor data to a server database. When the field's moisture and temperature are reduced, the irrigation will be automated. Periodically, the farmer receives notifications via mobile detailing the state of the field. This technology will be more beneficial in locations with a water shortage and will be effective at meeting its needs.

Key words: Internet of Things, Arduino Uno, Node MCU, GSM Module

1. INTRODUCTION

IoT is transforming the agricultural industry and giving farmers the tools, they need to combat the enormous challenges they confront. Agriculture must address growing water shortages, a lack of available land, and the rising consumption demands of a growing global population. These problems are being addressed by new cutting-edge IoT applications, which are also improving the quantity, quality, sustainability, and cost-effectiveness of agricultural produce. As the world's population is expanding quickly today, agriculture is becoming more crucial to supplying the demands of the human race. Agriculture does, however, require irrigation, and since we use more water each year than we do for precipitation, growers must develop ways to do so while still getting the best output possible. However, in the modern day, farmers use irrigation method.

2. LITERATURE SURVEY

The writers of the studied literature have utilized mobile and the Internet to monitor and regulate the flow of water. The system has the potential to be helpful in an isolated place with limited water availability and controlling the irrigation process without human involvement because of its energy independence and low cost. The level of moisture in the soil has been verified using an acoustic-based approach. In this method, it has been found that the speed of sound reduces as soil moisture content is reduced. Water flow monitoring and control have been done via wireless sensor networks from a distance. Mobile technology and various CPUs, including ARM, have also been employed in real time. The use of renewable energy sources, such as solar photovoltaic, has helped cut down on energy usage. The system helps with water management decisions and uses a GSM module to monitor the entire system. This system uses internet of things (IOT)-based smart watering techniques. This system installs sensors in agricultural fields and uses a mobile data communication network to measure the soil moisture value, water level in the tank, and well water. The mobile integrated smart irrigation management and monitoring system using IOT is analyzed by the web servers using intelligent software. International Conference on Communication and Signal Processing the information and take the required action based on the outcome. The device provides the precise amount of water needed for a plant or crop while continuously monitoring the water level in the tank. The device measures the soil's temperature and humidity to maintain the balance of nutrients needed for plant growth.

In this study, sensors for temperature, humidity, and soil moisture were put in the plant's root zone and transmitted data to an Android application. To control the amount of water, a microcontroller was programmed with the threshold value of a soil moisture sensor. The android app displays information on temperature, humidity, and soil moisture.

The goal of the paper "Automatic Irrigation System on Sensing Soil Moisture Content" is to develop an automated irrigation mechanism that activates and deactivates the pumping motor in response to the amount of moisture in the soil. Only the soil moisture value is taken into account in this article, however the suggested project added temperature and humidity values as an expansion to the current project. Short Message Service (SMS) with Wireless Sensors for Remote Monitoring in a Farmhouse. In this study, data is sent via SMS, however the suggested solution provides values to a mobile application. This proposed article describes an Arduino-based remote irrigation system created for an agricultural plantation. The system is installed in a remote area and supplies the plantation with the water it needs when the soil's humidity falls below a predetermined level. However, we were unaware of the soil moisture level at the time. To address this shortcoming, a proposed system was included with an additional feature that displayed the soil moisture value and temperature value on the farmer mobile application.

3. PROPOSED SYSTEM

Compared to conventional irrigation systems, smart irrigation systems have a number of benefits. Based on factors like soil moisture and forecasts, intelligent irrigation systems may adjust water levels. Wireless moisture sensors are used for this, which assist the system determine whether or not the landscape requires watering by communicating with the smart irrigation controls. The smart irrigation controller also receives local meteorological information that may be used to help it decide when to irrigate a landscape. The Smart watering System is an Internet of Things (IoT)-based technology that may automate watering by analyzing soil moisture and weather conditions (such rain). The BOLT cloud page will graphically depict the sensor data.

The key component of this system's operation is coupling the soil moisture sensor, which was previously incorporated into the plant, with the Arduino microcontroller, which is also coupled with other electronic parts. The sensor measures the soil moisture and transmits the results together with other data to the microcontroller, which in turn operates the pump. The microcontroller transmits a signal to the relay module, which subsequently activates a pump and supplies the plant with a particular amount of water, if the soil moisture level falls below a predetermined threshold (in this case, 60%). When there is enough water delivered, the pump stops operating. The power supply's job is to power the entire system, and the suggested voltage should adhere to the microcontroller's input supply range, which is between 7V and 12V. Additionally, we employ a humidity sensor, LM35 temperature sensor, and water level sensor. When the water reaches that point, any two of the magnetic strip lines will shorten, signaling the buzzer to turn off the engine. The water level sensor is placed in the field so the entire area is covered and it is at a certain height. By detecting changes in voltage at the output port, the LM35 sensor senses temperature, and a humidity sensor detects air humidity. When the temperature exceeds 40 degrees Celsius, the input is given to Arduino, which then sends it to the motor driver, which starts the motor after determining that there is sufficient moisture in the soil.

For the purpose of monitoring plants in real time, we employ cameras. The fruit or vegetable will be green for the first several days or months. It then turns to its true color. The camera records all of these changes, and they are all saved in the database. We have photos of healthy and sick leaves in the database. If the plant has any insect damage, MATLAB will be used to analyses it, and the results will be compared to the database's data. When a disease is found, fertilizers should be used according to the advice sent. The filter is a device that lets the rectifier's output's ac component pass while blocking the load's dc component. As a result, a constant dc voltage will be the filter circuit's output. Capacitors, resistors, and inductors can all be used in combination to create a filter circuit. Because it only allows dc components to flow and prevents ac signals, inductors are utilized. Using a capacitor allows ac to pass while blocking dc. Circuit with a filter capacitor that blocks DC and passes AC. Due to their extremely strong resistance to low, capacitors.

3.1 Block Diagram Description

The schematic block as shown in Figure 1 includes a power supply unit, an Arduino microcontroller, sensors, a relay, a light-emitting diode (LED), a relay, an Ethernet shield, and a DC motor. Temperature sensors sense the temperature and offer the level of temperature, whereas humidity sensors are used to monitor the amount of water in the air. The water content of the soil can be determined with a soil moisture sensor. An Arduino board can connect to the internet via the Arduino Ethernet Shield. The Wisent W5100 Ethernet chip (datasheet) serves as its foundation. A microcontroller board called the Arduino Uno is based on the ATmega328.The microcontroller is used to carry out the tasks. The block diagram of the drip irrigation field monitoring and controlling working model is depicted. The Arduino microcontroller receives all the sensors as input, and the output is displayed on an LCD screen or audible as a buzzer. The analogue input of the temperature and soil moisture sensors is connected to the Arduino's ADC, and the LCD receives the output. Based on the location of the sensors, the relay module functions as an electromagnetic switch that automatically switches on or off the motor pump.

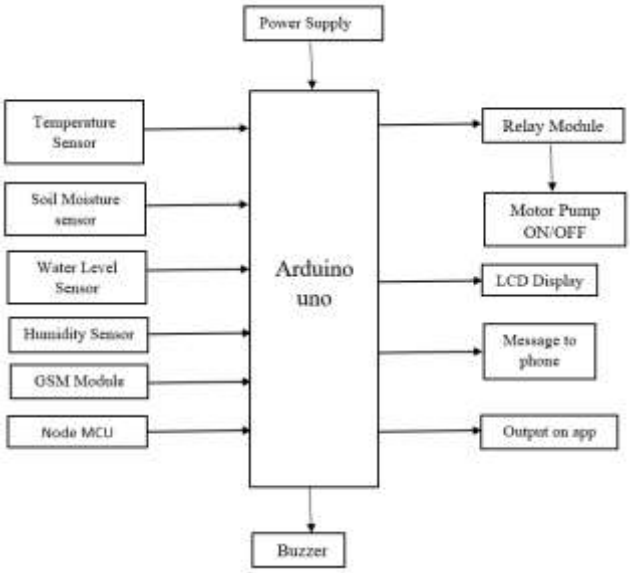

Figure 1: Block diagram of proposed method

4. RESULTS

4.1 Hardware Connections

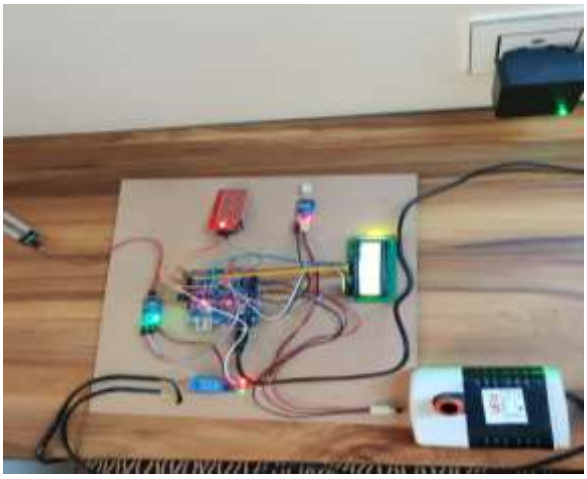

Figure 2: Hardware Connections

Figure 2 shows prototype of the project where temperature sensor, humidity sensor, water level sensor and soil moisture sensor are connected to the Arduino as inputs and power supply of 230V is given using adaptor. As soon as the temperature exceeds the limit of 40 degree Celsius or humidity exceeds the percentage of 60% the buzzer alert is given to the user to be cautious.

4.2 Output on LCD display

The output on LCD display as shown in Figure 3 displays temperature in Celsius, humidity in air is shown in percentage and the moisture in soil is displayed in percentage, so that the further decision of watering the plant to what extent is made.

Figure 3: Output on LCD display

4.3 Output on application

Figure 4: Output on Application

The output on application is shown in Figure 4 which is created where temperature is shown in Celsius, humidity in air is shown in percentage, the moisture in soil is displayed in percentage and the water level of the soil is displayed, so that the further decision of watering the plant to what extent is made and also the motor ON or OFF condition is monitored.

5. CONCLUSION

In this work, we successfully create a system that, by examining the ground's moisture level, can assist an automatic irrigation system. Being able to control and regulate watering without any manual input makes the smart irrigation system beneficial. This project's main users will be farmers and gardeners who lack the time to water their plants and crops. The farmers are having a lot of trouble watering their fields. It's because they don't know when the current will be available so they can pump water.

The temperature and moisture levels of the plants are measured by the sensors for moisture and temperature. The Arduino UNO board receives a signal from the moisture sensor if the moisture level is determined to be below the specified level. The Arduino UNO board then sends an alert message, instructing the water pump to switch on and feed the appropriate plant with water. Additionally, without going, you may check the temperature and motor status on your phone. The system has a proprietary sensor design for ease of use,

scalability, cost effectiveness, and power efficiency. Future tasks should be completed in order to advance the system to a more developed stage. The technology could be upgraded to allow for use outside. A smart irrigation system will make the current system more creative, user-friendly, time-saving, and effective. four parameters are measured, including soil moisture, temperature, humidity, and an intruder detection system. Thanks to server improvements, farmers can now be informed on the state of their fields at any time.

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