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Smart Irrigation System Using IOT

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ABSTRACT

Plants are the most essential factors for all the living creatures on the earth. It is very much important to focus on the cultivation of crops and plants. The growth of the plants is affected by the environment like temperature, water, humidity, fertilizers, and so on. Especially water affects the growth of the plant is a vital way. If the plants get water less than the ideal, it will affect the growth of the plant; or if the level of water increases, it will cause fungi and damage plants. This research work aims to provide an IoT-based solution to monitor the humidity level of the plant and irrigate accordingly. IoT based tool has been developed which can be controlled through a mobile app. The proposed application will help reduce the wastage of water and water the plant when needed.

Keywords : IoT, Agriculture, Irrigation, Sensors.

I. INTRODUCTION

Human beings are very much evolving in agriculture methods such as subsistence farming, shifting agriculture, intensive farming, crop rotation, permanent agriculture or sedentary cultivation, and many other methods. They also very much evolve in irrigation systems; irrigation is the process of applying water to the crops artificially to fulfil their water requirements. Nutrients may also be provided to the crops through irrigation. The various sources of water for irrigation are wells, ponds, lakes, canals, tube wells, and even dams. Irrigation offers moisture required for growth and development, germination, and other related functions.

The proposed work will help to improve the level of the irrigation system. Throughout the world, irrigation (water for agriculture, or growing crops) is probably the most important use of water. Estimates vary, but about 70 percent of the world's freshwater withdrawals go towards irrigation. The growth of the plant is affected either by a lack of water or excess water. It is important to understand the water required for the plant before irrigation.

Irrigation management plays a vital role in ensuring that crops are getting the right amount of water at the right time. The Internet of Things (IoT) is making it easier for farmers to monitor and control water resources to meet demand and also reducing waste and cutting operational costs. This research work uses NodeMCU ESP8266 to control the motor (i.e., to start and stop the motor) and the rest of the whole irrigation process will be automatically controlled by itself.

This article elaborates the literature review in section 2. Section 3 explains the methods and tools used to

develop the application. The implementation process is explained in section 4. Section 5 narrates the conclusion and future work of the research work.

II. RELATED WORKS

In this section existing research works carried out on smart irrigation systems are narrated.

DhanajiBaravadeet.al., [1] have developed a smartphone application to improve the irrigation system. An automated drip irrigation system is implemented which is connected with the smartphone application. This application can be accessed by the farmer. The proposed application used an Arduino kit.

HeenaNankaniet.al., [2] have developed a smart water monitoring system for the agriculture domain. This research work used IoT-based sensors to monitor the quality of water and produce the data of detection of contamination, turbidity, temperature, water level, and water flow. The proposed application used Arduino and sensors to monitor and store the results on the cloud server.

T, Rajakumaret.al., [3] have developed a smart monitoring system for the agriculture domain. In this research work, a kit is developed using Arduino with soil moisture to monitor the water level of the plant. If the level of soil moisture goes below the threshold it will automatically trigger the water pump to water the plant. Once it reaches the required humidity level water pump will be turned off automatically. This application can be applied to homes, gardens, and farming areas.

Ashwini [4] has developed a smart irrigation system to improve the production of crops. This research work used an Arduino kit with wireless transmission control to read the soil moisture, air moisture, and temperature of the plant and send the notification to the farmer. Based on the requirement farmer can water the plant. This system helps to reduce water consumption manually.

Iqbal Ahmed et.al., [5] have developed a smart irrigation system with the components of a micro-controller and sensor integration of a water pump. The proposed system is implemented at the University of Chittagong. The Arduino-based sensor integrated pump will read the level of water in the land and send the notification when the land is dry. It maintains the motor manually.

Priyadharsneeet.al., [6] have proposed IoT based automated irrigation system. Arduino processor which is connected with soil moisture and temperature sensor to monitor the plant. Once the soil moisture goes below the required limit, the system will send a message to the user to water the plant.

Mythiliet.al., [7] have proposed a smart farm monitoring system to improve the cultivation by monitoring the soil moisture and temperature of the plant. Arduino-based sensors are used to monitor the crop and help the farmers to increase the average crop yield ratings, and plant quality through smart farming.

Goriet.al., [8] have proposed an IoT-based system to handle irrigation smartly. It triggers the sprinkler to supply water to the plants based on the requirements. Arduino processor with soil moisture sensor is used to monitor the plant's moisture level and water accordingly.

Sanjay et.al.,[9] have developed an automatic irrigation system to monitor the plants through IoT-based sensors. The proposed system will sense all the environmental parameters and send the data to the user via the cloud using an Arduino processor and sensors. Users can control the system using an actuator and can access it remotely.

Sumathiet.al., [10] have developed IoT based cloud server for a smart irrigation system. This research work focused on developing an android application to control the irrigation which is connected with a soil moisture sensor to monitor the humidity level of the plant. The application used an Arduino processor to

integrate sensors and sends the report to the cloud server.

Priyaet.al., [11] have proposed a Remote Monitoring System (RMS) for the agriculture domain to improve the irrigation system. In this research work, sensor technology and wireless networks integration of IoT technology with Arduino has been studied and reviewed based on the actual situation of the agricultural system.

Naiket.al., [12] have proposed sensors integrated with an Arduino to monitor the irrigation system and to water the plant. This research work triggers water pumps automatically when the soil moisture goes below the threshold value. This system is controlled by the Android mobile application by the user.

Tushar et.al., [13], Nandhini et.al.,[14], Nurulisma et.al.,[15], Vijayabanu [16], aman et.al., [17], Velmurugan et.al., [18], Awais et.al.,[19], Singla et.al., [20], AshifuddinMondal [21], Ravi Kumar et.al [22] have proposed smart irrigation system. They have developed IoT application using Arduino with sensors to monitor the moisture level. Table 2.1 gives a comparative study of the existing smart irrigation systems proposed and developed last three years.

III. METHODS AND TOOLS

This section explains the methods and tools used to develop the proposed application. There are different types of irrigation methods as given in figure 3.1

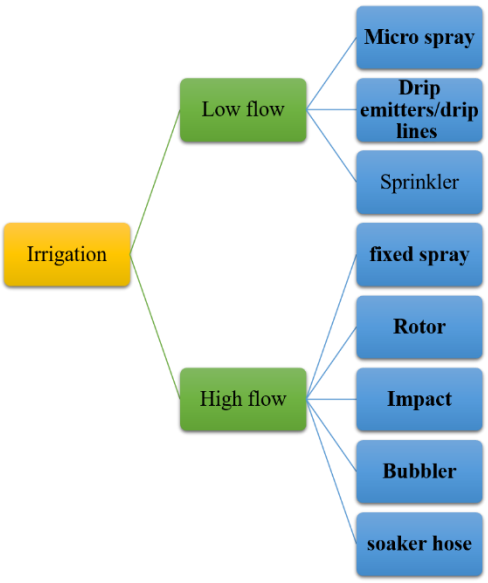

Figure 3.1 Types of Irrigation System

Among the different types of irrigation system, drip and sprinkler irrigation systems are the most preferable it reduces the high level of water wastage. This application uses sprinkler method to water the plants. The proposed application uses soil moisture sensor, temperature sensor and humidity sensor to monitor the water level of the soil. The sensors are linked with NODEMCU processor to access and the application is linked with Blynk mobile app.

Soil Moisture sensor

Soil moisture sensor measures the volumetric water content in soil. This sensor allows the farmers to take necessary action based on the land condition. It helps in managing irrigation systems more effectively and efficiently. It helps farmers to save water, to increase yields and to increase quality of the crop.

3.2 Soil Moisture sensor

Temperature sensor

A temperature sensor is a device, typically, a thermocouple or RTD, that provides for temperature measurement through an electrical signal. A

thermocouple (T/C) is made from two dissimilar metals that generate electrical voltage in direct proportion to changes in temperature.

3.2 Temperature sensor

Humidity sensor

A humidity sensor is an electronic device that measures the humidity in its environment and converts its findings into a corresponding electrical signal. There are two types of humidity sensor viz., relative humidity sensor and absolute humidity sensor. Relative humidity (RH) sensor is used in this research work. RH is calculated using the following formula:

$$RH = \frac{amount\ of\ water\ vapor\ present\ in\ the\ air}{amount\ of\ water\ needed} \times 100$$

3.3 Humidity sensor

NodeMCU

NodeMCU is an open-source Lua based firmware and development board specially targeted for IoT based Applications. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module.

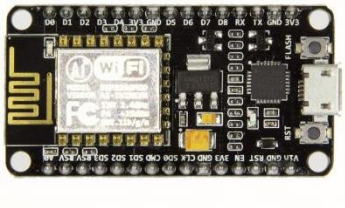

Figure 3.4 NodeMCU

4. Implementation

The Smart Plant Watering System has wide scope to automate the complete irrigation system. This research work proposedIoT-based Plant Watering System using ESP8266 NodeMCU Module and DHT11 Sensor.

It will automatically irrigate the water based on the moisture level in the soil and help keep track of the land condition. The System will consist of a water pump which will be used to sprinkle water on the land depending upon the land's environmental condition such as Moisture, Temperature, and Humidity. The proposed sensors are linked with NodeMCU as given in figure 4.1

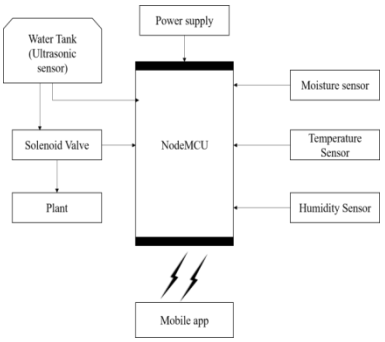

Figure 4.1 Circuit Diagram

It is important to note that the different crops require different Soil Moisture, Temperature, and Humidity Condition. When the soil loses its moisture to less than 50% then the Motor pump will turn on automatically to sprinkle the water and it will continue to sprinkle the water until the moisture goes up to 55% and after that, the pump will be turned off automatically. User can control the device using the Blynk Application which is a readymade IoTplatform that allows you to quickly build interfaces for controlling and monitoring the hardware from smart

phone. After downloading the Blynk app, user can create a project dashboard and arrange buttons, sliders, graphs, and other widgets onto the screen as shown in figure 4.2.

Figure 4.2 Mobile app screen of the proposed application

Soil moisture sensors measure the water content in the soil. Moisture in the soil is an important component of the atmospheric water cycle. The sensor module outputs a high level of resistance when the soil moisture is low. It has both digital and analogue outputs. The digital output is simple to use, but it is not as accurate as analogueoutput based on moisture level motor gets turn on/off automatically.

The moisture, temperature, and humidity sensor sense the data and send it to the device to which the blynk application is paired.This data transfer is done through NODE MCU ESP8266.Then the device checks the soil moisture level.If the power supply is failed then the device will turn off (both power and internet).If the level is lesser than 55% then the motor automatically on and when the level reaches the threshold percentage the motor will goes off.Since it is wireless, user can access it from anywhere and anytime.

IV. CONCLUSION

This research work proposed the smart irrigation system. The existing research works carried out on smart irrigation systems are analysed and the results are tabulated. The comparative study reveals that the existing applications are developed using Arduino microcontroller and most of them are operated manually. The proposed application is developed with NodeMCU which is high storage, consumes less power supply and has Wi-Fi access when comparing with Arduino. This application is implemented with soil moisture sensor, temperature sensor and humidity sensor to read the soil status to water. Once the moisture level of the soil goes below the threshold value, it will automatically trigger the water pump to water the plant. When the moisture reaches 55% the motor turn off automatically. In future, the application can be implemented to water big farms and grounds.

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