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A study on smart irrigation system using IoT

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ABSTRACT

Agriculture plays an important role in the life of a Gross Domestic Product of every country. It is the backbone of economy of every country. Many problems have been found in this field. As the most serious problem is the shortage of water resources for the present as well as for future generation. It is necessary to adopt some smart techniques to preserve the water. The most highlighted feature of this paper is how smartly and automatically control the water supply to the agriculture fields according to the need. For this, sensors used are soil moisture sensor and DHT-11 temperature sensor. All the information is sent on the farmer mobile application using Wi-Fi Relay Module and Arduino UNO R3.

Keywords— *Arduino Uno (R3), Soil Moisture Sensor, DHT-11 Temperature Sensor, Android Application*

1. INTRODUCTION

Agriculture plays a major role in the GDP of every country. It also contributes a lot to the economy of India. It is observed that 70% of India's population depends on agriculture for employment. IoT is helping the farmers to fight with most of the agriculture problems. As India is the second largest country in the growth of population so it is necessary to increase the rate of production of agriculture to meet the population food consumption rate. As mat initiatives have already taken by the Indian government to promote Agriculture.

Every year irrigation requires more water consumption than rainfall, which will lead to a critical problem of water resources for the future generation. It is also difficult for farmers to find ways which need less water to grow crops. From many surveys, the report is that agriculture uses 85% of the fresh water. If this percentage of fresh water usage continues to grow, then it becomes a serious problem with respect to an increase in population growth and increases in demand for food.

To preserve water resources for future generation and for proper usage of water resources, it is necessary to adopt some strategies so that minimal water is used as per requirement. There should be some techniques which must be implemented to stop the wastage of water resources.

Iot is a technology which enables us to adopt the strategies to monitor the usage of water resources in agriculture fields via connecting with android applications. The soil moisture sensor is placed in the soil with crops, which checks the moisture level of the soil and send signals to Arduino. Arduino takes the decision of whether to switch-on or switch-off the water motor. Using such techniques the wastage of water in agriculture can be stopped.

2. LITERATURE SURVEY

Archana and Priya (2016) published a paper in which determined value of soil and a temperature sensor placed in roots of plants control the switch on and switch OFF of the water motor. The drawback of their project is that they didn't include any technique to send the status of the agriculture field to the user. [1]

Karan Kansara (2015) build an automatic irrigation system project in which include the drawback of the Archana and Priyapublished paper. The drawback of this project is that this system is not capable to determine the nutrient value of the plants. [2]

The published paper on "Automatic Irrigation System on Sensing Soil Moisture Content" only includes measuring the moisture of the soil. Nut in our proposed system we have also included a temperature sensor along with soil moisture sensor.

Prof C.H.Chavan and P.V.Karnade (2014) proposed a system smart wireless sensor network for monitoring environmental parameters using Zigbee. In this model, nodes can send data to a central server, which stores and further process the data and then displayed it. The drawback is weather forecasting and nutrient content is not determined in their proposed system. [9]

3. PROPOSED SYSTEM

In this Proposed System, both the sensors DHT-11 temperature sensor and soil moisture sensors are connected to the input pins of Arduino Uno R3 microcontroller board. The Analog values produced from the sensors are converted to a digital output value by the Arduino Uno R3 microcontroller. The sensed values are displayed in the mobile application. The water motor gets switch-off/on automatically based on the sensed value with respect to an already fixed threshold value.

3.1 Algorithm

The steps that the system undergoes:

Step 1: Soil moisture sensor senses the moisture level of the soil (less than or more than).

Step 2: If the moisture sensed value is greater than the fixed threshold value than no need to switch on the motor.

Step 3: If the Moisture level is less than the threshold value, then the water motor is switch-on automatically.

Step 4: Once moisture level comes equal to the threshold value, it moves to its initial state (switch-off the water motor).

Step 5: End the process.

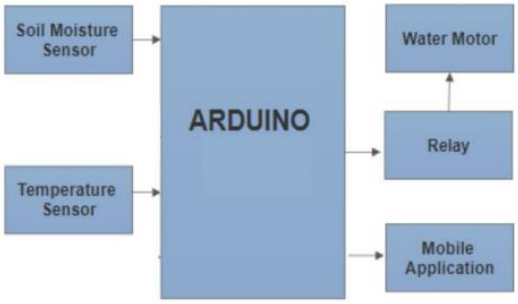

Fig. 1: Flowchart of proposed smart irrigation system

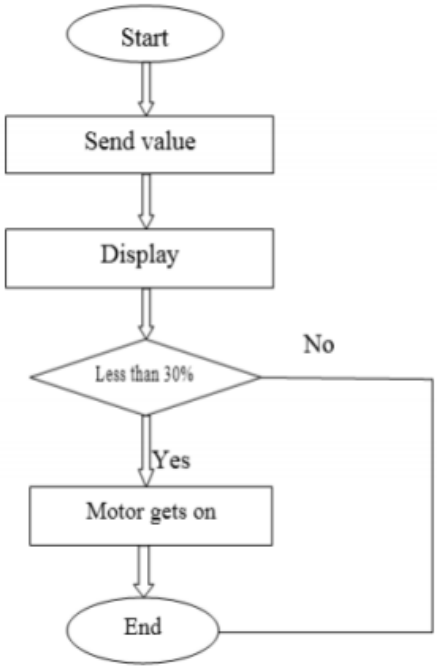

Fig. 2: State transition diagram of proposed smart irrigation system

4. COMPONENTS DESCRIPTION

4.1 Arduino UNO R3

The Arduino Uno R3 (also called ATmega328) is a dual-inline-package (DIP) microcontroller AVR microcontroller. In total, it has 20 I/O digital pins. Arduino computer programs can be easily loaded on it Arduino Uno R3 is the latest revision of the Arduino Microcontroller.

Fig. 3: Arduino UNO R3

4.2 Sensors

4.2.1 Soil moisture sensor: Soil moisture sensor has two probes which are used to sense the water level of the plants. The current is passed from these two probes them it estimates the resistance value of the moisture level. If the water level of the soil is then the resistance value is less and vice versa.

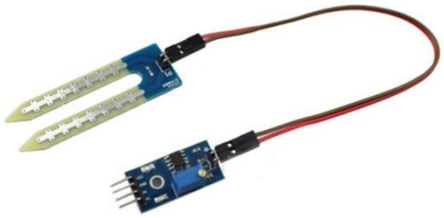

Fig. 4: Soil moisture sensor

Table 1: Soil moisture sensor specification

Input voltage	3.3-5V
Output voltage	0-4.2v
Input Current	35mA
Output Signal	Both Analog and Digital

4.2.2 Temperature sensor: The Temperature Sensor LM35 used to measure temperature in Celsius. The advantage of using the LM35 temperature sensor does not require any extra or external calculations.

Fig. 5: Temperature sensor

Table 2: LM35 temperature sensor specification

Sr. No.	Crop Name	Temperature	Moisture (%)
1	Rice	21-37	20-25
2	Wheat	10-15	14-20
3	Bajra	20-38	20-25

Table 3: Temperature and moisture requirements of major crops

PCB size	22.0mm X 20.5mm X 1.6mm
Working voltage	3.3 or 5V DC
Operating voltage	3.3 or 5V DC
Measurement range	20-95%RH; 0-50°C
Resolution	8bit(temperature) , 8bit(humidity)
Compatible interfaces	2.54 3-pin interface and 4-pin Grove interface

5. SOFTWARE USED

5.1 Arduino IDE 1.8.9

It is the open source Arduino Software which is used to Arduino based code and upload it to an Arduino board. It can run on any platform like on Windows, Mac OS X, and Linux. Its environment is written in Java and other open source software.

5.2 Bluetooth terminal android application

Table 4: Bluetooth terminal android application

Platform	Android
Version/Release Date	1.0/21-4-2014
Requirement	Android 2.2 and above

6. SCREENSHOTS

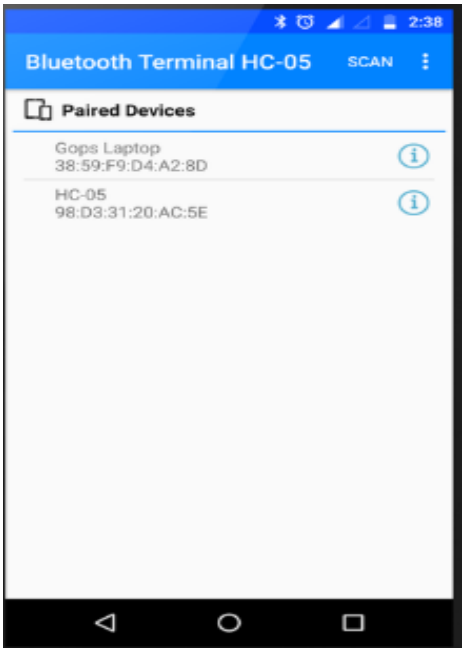

Fig. 6: Bluetooth terminal android application

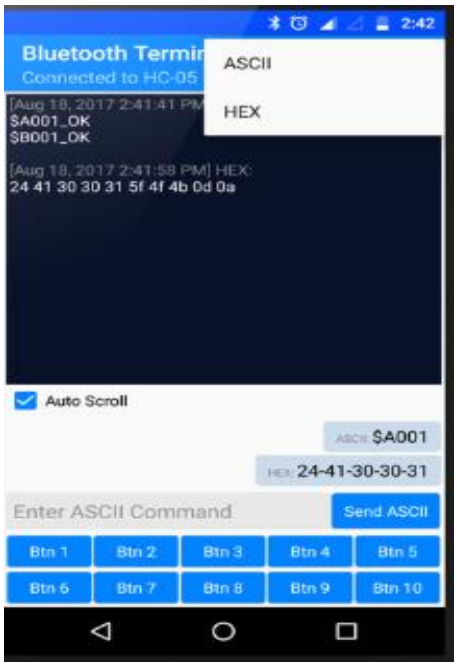

Fig. 7: Bluetooth terminal (when connected with Arduino via Bluetooth)

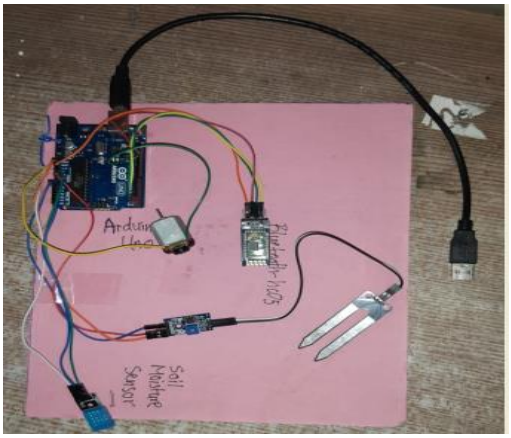

Fig. 8: Proposed system of smart irrigation system using IoT

7. CONCLUSION and FUTURE SCOPE

This automated Smart Irrigation System using IoT is found to be cost-effective for enhancing the techniques to preserve water resources and to optimize them for agriculture production. This system helps the farmer by working automatically and smartly. With placing multiple sensors in the soil, water can be only provided to the required piece of land. This system requires less maintenance so it is easily affordable by all farmers. This system helps to reduce water consumption. With using this system the crop production increases to a great extent.

As per future perspective, this system can be the more intelligent system which predicts user actions, nutrient level of the plants, time to harvest, etc. With using Machine Learning algorithms more advancements can be done in the future which will help farmer a lot and water consumption can also be reduced in agriculture.

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