Project REPORT

Title: IoT Based Smart Irrigation System

Group no-1

EEE 310

Communication System I Laboratory

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IoT Based Smart Irrigation System

Abstract:

Automation of farm activities can transform agricultural domain from being manual and static to intelligent and dynamic leading to higher production with lesser human supervision. This project demonstrates an automated irrigation system which monitors and maintains the desired soil moisture content. A low-cost Wi-Fi microchip ESP8266 is used to implement the control unit. The setup uses soil moisture sensors which measure the percentage value of moisture level in soil. This value enables the system to use appropriate quantity of water which avoids over/under irrigation. IoT is used to keep the farmers updated about the status of field. Information from the sensors is regularly updated on Blynk IoT platform's webpage for the convenience of the farmers.

1. Introduction:

Agriculture is un-questionably one of the largest livelihood providers in Bangladesh. With the rising population, there is a need for increased agricultural production. To support greater and more efficient production on farms, the requirement of the amount of water used in irrigation also rises. Currently, agriculture accounts for almost 70% of the total water consumption in Bangladesh [1]. Unplanned use of water inadvertently results in wastage of water which is quite common in our country [2] . This suggests that there is an urgent need to develop a system that prevents water wastage without imposing pressure on farmers. In the Internet era, where information plays a key role in people's lives, agriculture is rapidly becoming a very data intensive industry where farmers need to collect and evaluate a huge amount of information from a diverse number of devices (ex. sensors, farming machinery, etc.) to become more efficient in production and communicating appropriate information. With the advent of open source ESP8266 boards along with cheap moisture sensors, it is viable to create devices that can monitor the soil moisture content and accordingly irrigate the fields only whenever needed.

2. Proposed System

The system is a combination of hardware and software components. The overall block diagram is shown below:

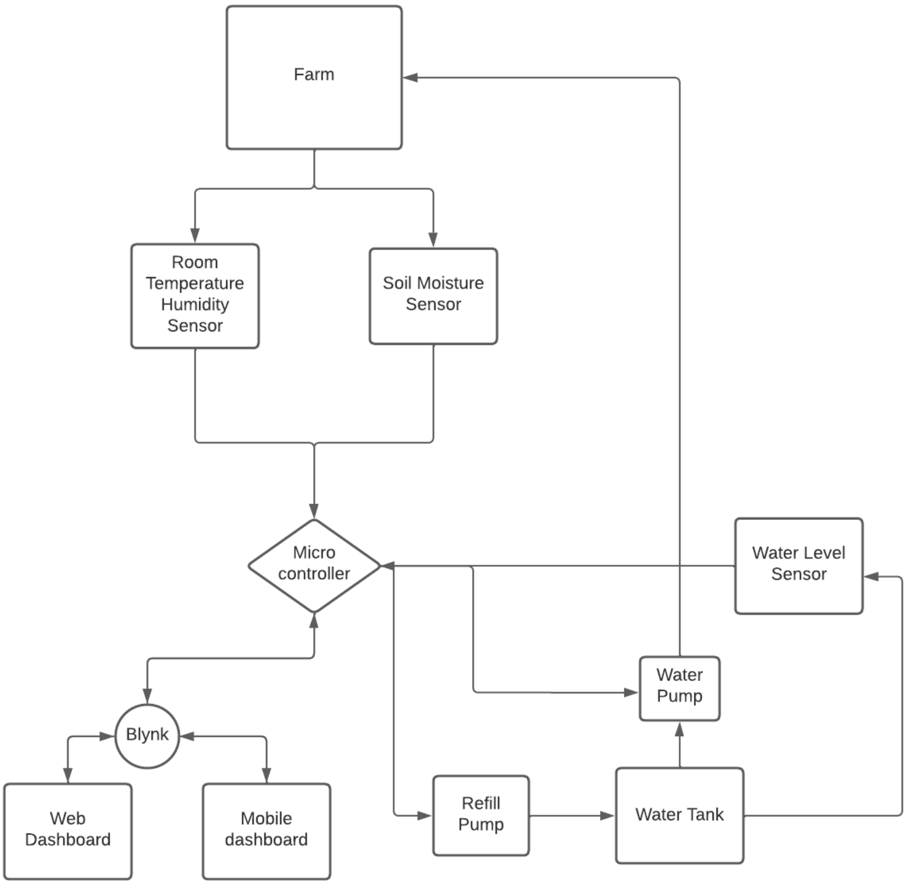

Figure: Block diagram of our proposed system

3. Workflow:

At first, we brainstormed together to implement the system in the best way possible. After hours of doing so, we finally selected the list of equipment that will be required for successful implementation. Then we ordered some of the equipment online from techshopbd and robotics bd for the initial phase of our project. Then step by step we collected all the other necessary equipment.

Then, our main task was to test the hardware to see if they are working properly or not. We tested each sensor individually by watching their output in the serial monitor. We have also tested the submersible pumps (Irrigation and Refill motors) in the same way. In this process, we already have the codes for reading the data and showing the outputs.

After the above-mentioned process, we assembled the code together with all the sensors and motors connected in the appropriate manner to ESP8266. After debugging, we finally uploaded our code to the Wi-Fi module.

Initially we had our power supply coming directly from a laptop. But after that we managed separate adapters to power ESP8266 module and the pumps which was the last step after which our project was almost complete. The last step was to put our project in an appropriate frame.

4. Description of the operation:

4.1. Data Collection:

This is the first step of our proposed system where Soil Moisture sensor and DHT11 Temperature and Humidity sensors are used to collect data from our desired field. We also used a sonar sensor to detect the water level of the tank.

(a)

(b)

(c)

Figure: (a) Soil Moisture Sensor

(b) DHT11 Temperature and Humidity Sensor

(c) Sonar Sensor (HC – SR04)

According to crop types, we can set the minimum and maximum moisture levels using Blynk app.

4.2. Controlling unit:

After collecting data using our sensors, they will be sent to our programmable microchip. The main function of our microchip is to analyze the data from the sensors and suggest appropriate output. In our case, it turns on the refill motor if the water level of the tank goes below 3 cm (about 1.18 in) and turns off if the water level reaches 6 cm (about 2.36 in). Again, the irrigation will turn on if the moisture level goes below the minimum level and the same motor will turn off if the moisture level goes above the maximum level.

We have programmed the micro-chip using the Arduino platform and uploaded the code to the chip. This is how all the aforementioned thresholds are set.

(a) (b)

Figure: (a) ESP8266 NodeMCU V3 Development Board

(b) Relay Module

Relay Module is used to turn on high devices that require high power that the micro-chip could not provide.

5. Performance Analysis

While we were testing the individual sensors, DHT11 Temperature and Humidity sensor did not work, after connecting and disconnecting several times, it finally worked. After uploading the code, everything worked almost fine. But there we some lag due to low internet speed. Initially moisture sensors maximum value used to reach to 100% but after testing for several times, the maximum it can reach is only about 60%.

6. Cost Analysis

Component Name	Price (BDT)
Node MCU (ESP8266) Microcontroller × 1	350
Submersible Pump 12V × 2	240
Temp. & Humidity Sensor	180
Soil Moisture Sensor	80
Breadboard	50
Water Pipe ¼ inch, 6 feet	120
Jumper Cable × 30	90
Wire 12 feet	120
Power Adapter 12V	150
Breadboard Power Supply Stick	100
1 Channel 5V Relay Module × 2	160
Power Adapter 5V	300
Sonar Sensor (HC-SR04)	90
Plastic Container Box × 2	230
Total	**2260**

7. Future Prospect:

To improve the efficiency and effectiveness of the system, the following recommendations can be put into consideration. The farmer may choose to stop the growth of crops, or the crops may get damaged due to adverse weather conditions. In such cases, farmers may need to stop the system remotely. The idea of using IoT for irrigation can be extended further to other activities in farming such as cattle management and fire detection. This would minimize human intervention in farming activities.

9. Conclusion

A system to monitor moisture levels in the soil was designed and the project provided an opportunity to study the existing systems, along with their features and drawbacks. The proposed system can be used to switch on/off the water pump according to soil moisture levels thereby automating the process of irrigation which is one of the most time-consuming activities in farming. Agriculture is one of the most water-consuming activities. The system uses information from soil moisture sensors to irrigate soil which helps to prevent over irrigation or under irrigation of soil thereby avoiding crop damage and prevents wastage of water at the same time. Through this project it can be concluded that there can be considerable development in farming with the use of IOT and automation. Thus, the system is a potential solution to the problems faced in the existing manual and cumbersome process of irrigation by enabling efficient utilization of water resources.

10. References

[1] Smart irrigation technology for sustainable agriculture (thefinancialexpress.com.bd) Friday, 26 August 2022

[2] Farmers waste 800 litres of water to grow a kg of paddy | Dhaka Tribune Published at 01:42 am January 13th, 2019