Soil and Plant Monitoring System using IoT

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Abstract

Gardening plants involves a lot of manual effort like watering plants based on moisture levels of the soil. Automation in Gardening is hardly seen in India which is a drawback. This device's objective is to ensure facile in maintaining gardens. NodeMCU allows connection of different devices and sharing data between them through a Wi-Fi protocol. This device uses IoT platform in recognising the field conditions and sending the telegraphic alerts. When the soil moisture content is decreased, the owner gets a notification to water the plants in a mobile app. He just needs to turn on the press the button in the app which turns on the solenoidal valve connected to the over head tank. Socio-ecological systems implement this device for gardening in their balconies or on their roof tops.

Keywords - Garden, NodeMCU, Wi-Fi protocol, Mobile app.

I. Introduction

Farming and Gardening are widely seen practices in India. Agriculture is one of the major sectors in India [1]. But for most of the part, there is no automation involved in agriculture or gardening in India. A lot of manual effort is involved [2]. To change this, IoT can be used to automate few tasks in Gardening. One of such few tasks is watering the plants based on the moisture levels present in the soil. By automating few tasks like this, we can improve the efficiency of farming activity in fields and gardens which leads to less manual work and ultimately leading to better productivity of crops and plants.

IoT (Internet of things) can help in examining the moisture content of soil [3]. A network of sensors has been installed to collect the real time data at various environmental situations. The microcontroller collects data through its sensors and checks for various given conditions. The system can water the plants, monitor temperate and humidity, detect rains, etc. and it will send notifications to the user on an app. The data is also transmitted wirelessly to a web portal, Thingspeak [4] to understand the conditions of surrounding environment.

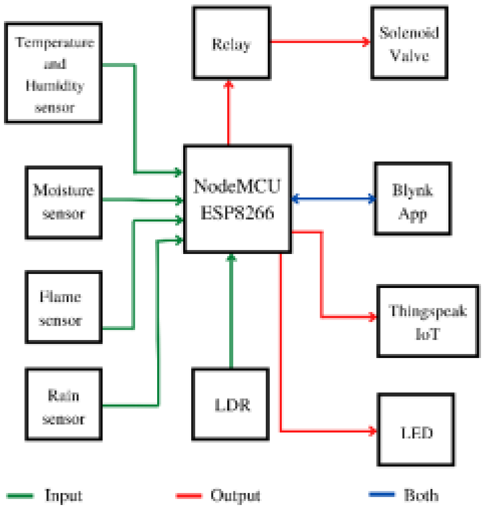

Fig1: Block diagram

II. Literature Survey

A number of individuals and teams did their research on plant monitoring system. In our project, we increased the number of sensors in the system for reading more environmental parameters. This system [5] is collecting the soil moisture values using a capacitive moisture sensor but the system doesn't water the plants based on the moisture levels of the soil. So with this project, the user will get updated regularly on the moisture levels but he/she still needs to water the plants manually. While in this project [6], the motor is added along with the soil moisture sensors. This can water the plants automatically but the user isn't getting any updates about the sensor data in this project. While in this project [7], the sensors are increased and data is sent to the user. But the project doesn't do watering to plants automatically. While in [8] and [9], the projects take various sensor values and water the plant automatically, but our project is equipped with a bit more sensors thereby making the system more useful.

For this product, NodeMCU module is used to build a detection system with the help of hardware and software coordination. In software implementation, the Arduino IDE platform is used where the NodeMCU ESP12E board is installed. The entire code is written in Arduino language and dumped into NodeMCU after flashing it. In hardware implementation, the NodeMCU,FC 28 moisture sensor,DHT11 temperature and humidity sensor, relay, solenoidal valve, flame sensor, rain sensor are used. These are all interconnected with the help of NodeMCU which gives instructions for the flow of electrical signals.

III. Software and Hardware Implementation

The entire code is written in understandable Arduino code. Initially define libraries for NodeMCU and Blynk .Then define the Wi-Fi SSID and password along with the API keys of Blynk and Thingspeak [4]. Firstly, whether the Wi-Fi is connected or not to NODEMCU is checked and the setup function is read where the sensors are initialized. Separate called functions are written for each sensor which are accessed to Blynk app. The ports defined in Blynk are initialized corresponding to sensor variables to send the values to Blynk app and the corresponding reading. The button function is written to check the state of the button which is required to on the relay which acts as an intermediate between NODEMCU and solenoidal valve. Before the loop function, the host Thingspeak server is initialized to connect to it. Then after the loop function starts which executes for infinite times. In loop calling function the Blynk and timer functions are written which are calling functions that contains all the other sensors as a sub-functions. Then after the sensor values are sent to Thingspeak connecting to the client. If the Wi-Fi is disconnected in between, the NodeMCU checks for the Wi-Fi connection infinite times till it is connected and the continues the process.

1. NodeMCU (1.0) is the heart of the device which takes signals from all the sensors and implements the corresponding action that need to be taken. It is the enhanced version of the NodeMCU version 0.9 in-terms of performance.
2. This device can monitor the soil moisture level along with the climatic conditions surrounding the plants.This device can record values and store them on a cloud based server named as Thingspeak along with monitoring by a mobile app
3. The soil moisture sensor detects the moisture content present in the soil and it sends signals from time to time to the mobile app. If the moisture content is less, we can turn on the solenoidal valve according to our requirement through the app.
4. The DHT11 temperature and humidity sensors are used in this device, which sends the signal regarding the climatic conditions surrounding the garden to the cloud and mobile app through the NodeMCU module.
5. The Rain sensor present in the device consists a printed circuit which detects the rainfall using the principle of variable resistance.
6. The LDR present in the circuit turns on the lights automatically during the night time.

IV. Results

The readings of temperature and humidity sent by the DHT11 sensor and moisture content in the soil by FC 28 moisture sensor are sent into the cloud.

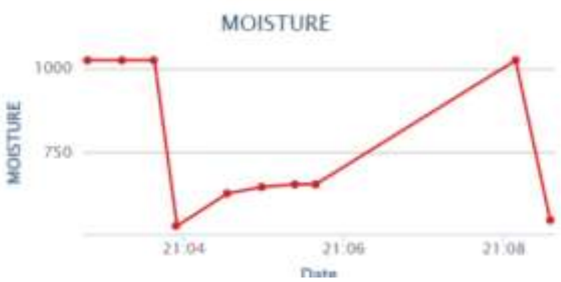

Fig 2: Moisture level readings

Fig 3: Temperature readings

Fig 4: Humidity readings

In real time implementation, the device is kept in the outdoor garden to test the working of the model and verify the various sensor values

Fig 5: Real time implementation 1

Fig 6: Real time implementation 2

Fig 7: Solenoidal valve controlling

The created mobile app interface allows to monitor the moisture, temperature, humidity and control the solenoidal valve. It also shows the notifications such as "Water your plants",

"Raining in Village".

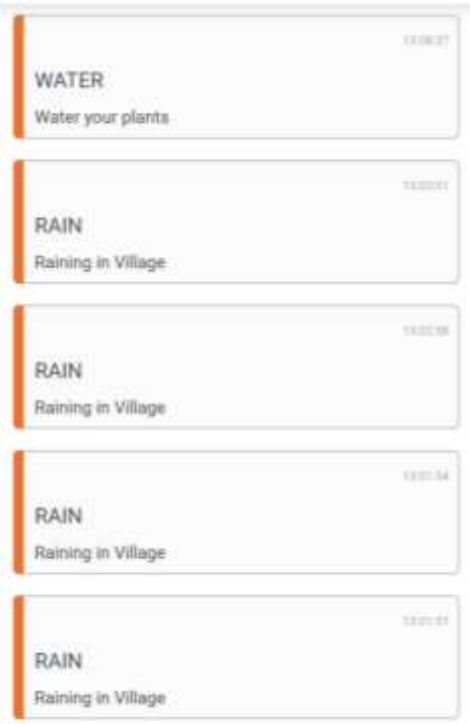

Fig 8: Mobile app notifications

Fig 9: Mobile app interface

V. Conclusion

This entire system is helpful in automation in gardens, which makes easier for an individual to monitor plants even in their work place. The system helped to reduce the manual effort in gardening. It also helped to monitor the conditions of surrounding environment and provide updates to the user through notifications on app. So the individual's time is saved by making use of sensors and NodeMCU in Agriculture and Gardening.

VI. References

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