International Journal For Advanced Research In Science & Technology
A peer reviewed international journal
www.ijarst.in
ISSN: 2457-0362

IoT based Smart Plant Monitoring System

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Abstract:

Internet of things is one of the most easily accessible form of connectivity. It can be used for a plethora of applications. Proper irrigation is still a challenge in most of the agriculture practices. Improper supply of water can affect both the soil and the crops/plant. A feasible monitoring or controlling system can be of great use to overcome this problem. In this project, IOT is employed to create a smart monitoring system for the crops/plant. This can help in improving the yield without affecting the soil quality. Measuring the features like temperature, humidity and soil moisture is the key aspect of the system.

Keywords-Internet of Things, Feasible Monitoring, Smart Monitoring, Without Affecting Soil Quality.

INTRODUCTION:

In India, Agriculture is the backbone of our country; most of the people depend on agriculture. The main issue in agriculture is water scarcity. The water resources is not employed in the good manner, so that the water is wasted. Proper irrigation is still a challenge in most of the agriculture practices. Improper supply of water can affect both the soil and the crops. A feasible monitoring or controlling system can be of great use to overcome this problem. Agriculture around the world plays important role in the development of agricultural nations. In India almost 68% of people depend upon farming and 1/3 of the national capital comes from agricultural. Problems related agriculture have been always preventing the progress of the nation. The solution to this problem can be solved by smart agriculture and modernizing the present traditional methods of farming. Hence the aim of the project is to implement hydroponic system using IoT technologies using Node MCU. The major features of this project include water driven agriculture system that will eliminate need for soil. With this hydroponic automated system, the crops area unit provided with water and nutrients reckoning on the sensors feedback like temperature and humidity sensor and electrical physical phenomenon circuits.

2. LITERATURE SURVEY:

[1] A. Pravin, T. Prem Jacob and P. Asha developed a module which enhanced the plant monitoring using IOT. They mainly focus on collecting the information from the field. The sensors devices can be used for collecting the information. The type of sensors that can be used are soil monitoring sensor, light sensor and temperature sensor. The temperature

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sensor will give the temperature details, the water content in the soil can be measured by using the soil monitor sensor and the light sensor is used to measure the field light intensity [2] Monirul Islam Pavel, SadmanSakib Hasan, Syed Mohammad Kamruzzaman and Saifur Rahman Sabuj propose IOT enable device which sends environment data in real-time to the database along with image of plant leaf to classify diseases using image processing and multiclass support vector machine. Figure 1 describes our proposed model. Image processing has been implemented to detect and classify the affected plant disease. In this process, the work is divided into four portion which are image acquisition and preprocessing, segmentation of affected region, feature extraction, classification using multi-class support vector machine algorithm. All data of sensors are obtained by Arduino and stored in a string format. Arduino then sides the whole string to Raspberry Pi 3, and it split all data based on coma and again stored in array. Afterward, a Uniform Resource Locator (URL) is created with our data server's IP address with corresponding database column name of each sensor and the obtained values of sensor.

3. WORKING METHODOLOGY:

In the block diagram, we can see that two sensors are used namely DHT11 for temperature and humidity, Soil moisture sensor, a relay circuit to control the water pump. Single bus data format is used for synchronization between DHT11 and MCU sensor. One communication process is takes about 4ms. Data consists of integral and decimal parts. A complete data transmission is of 32bit, and the sensor sends higher data bit first. Data format: 8bit integral humidity data + 8bit decimal humidity data + 8bit decimal temperature data + 8bit check sum (Error bits). If the data transmission is right, the check-sum should be the last 8bit of "8bit integral humidity data + 8bit decimal humidity data + 8bit integral temperature data + 8-bit decimal temperature data". All these sensors are interfaced to an open source Node-MCU (ESP8266) which will act as a microcontroller. This microcontroller is also interfaced with 5V power supply. Valves and solenoid Pumps are being controlled by the Node-MCU for efficient working of system. All this information is being send to a Blynk app. The controlling of whole system is automated using NodeMCU and IoT system. The dispenser is employed to combine the nutrients with the water. The water containing nutrients is passed to the pipes with facilitate to submersible pumps. The water that is not absorbed by the crops is reused by adding nutrients in keeping with the reading from sensor and once more passed to the pipes.

3.1 CIRCUIT DIAGRAM:

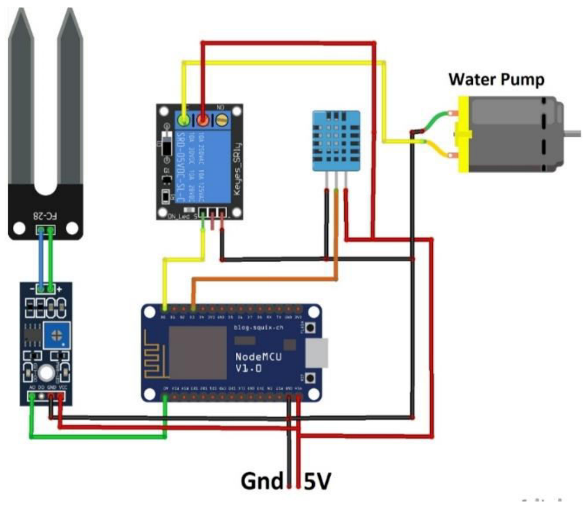

Fig 1: Circuit Diagram of the System

4. HARDWARE DESCRIPTION:

4.1 Node-MCU ESP8266:

Node-MCU is an open source firmware for which open source prototyping board designs are available. The prototyping hardware typically used is a circuit board functioning as a dual in-line package (DIP) which integrates a USB controller with a smaller surface-mounted board containing the MCU and antenna.

Fig 2 : Node MCU

4.2 Soil Moisture Sensor:

Soil moisture sensors measure the volumetric water content in soil. Since the direct gravimeter measurement of free soil moisture requires removing, drying, and weighing of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content.

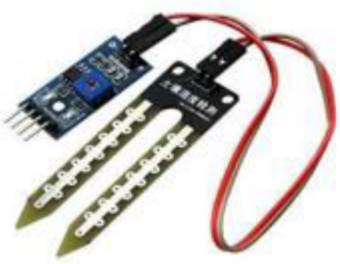

Fig 3: Soil moisture sensor

4.3 Relay Module:

Relay is an electromechanical device that uses an electric current to open or close the contacts of a switch. The single-channel relay module is much more than just a plain relay, it comprises of components that make switching and connection easier and act as indicators to show if the module is powered and if the relay is active or not.

Fig 4: Relay module

4.4 DHT11 Temperature sensor:

The DHT11 is a basic, ultra low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed). Its fairly simple to use, but requires careful timing to grab data.

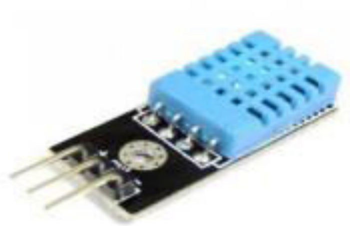

Fig 5: DHT11 sensor

4.5 WATER PUMP & PIPE:

To connect water pump motor we will need relay module. Because relay module uses 5V power supply and ESP8266 uses 3.3V power supply we will add transistor to drive 5V relay with 3.3V. Transistor is connected to ESP8266 D0 pin through resistor. If you connect relay directly to ESP8266 you will fry ESP8266. Other side of relay is connected to motor pump and adjustable power supply. Set voltage of motor pump between 6 and 9V.

Fig 6: Water Pump

5. SOFTWARE DESCRIPTION:

5.1 Arduino IDE:

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them.

Fig 7: Arduino Logo

5.2 THINGSPEAK :

ThingSpeak™ is an IoT analytics platform service that allows you to aggregate, visualize and analyze live data streams in the cloud. ThingSpeak provides instant visualizations of data posted by your devices to ThingSpeak. With the ability to execute MATLAB® code in ThingSpeak you can perform online analysis and processing of the data as it comes in. ThingSpeak is often used for prototyping and proof of concept IoT systems that require analytics.

5.3 HTTP SHORTCUTS:

A simple Android app that allows you to create shortcuts and widgets that can be placed on your home screen. Each shortcut, when clicked, triggers an HTTP request, with the possibility of processing and displaying the response in various ways.

6. ALGORITHM:

1. START

2. Initialize all the devices, DHT11, Soil moisture sensor, Buzzer, Node MCU and mobile application

3. Collect the sensors output .

4. Display the value on Mobile app

5. Check the value of Soil moisture

a. If value>threshold, turn on the water pump

b. If value<threshold ,go to step 4

6. Check the value of DHT11

7. Go to step 3

7 Hardware Implementation:

The hardware setup of the system includes NodeMCU as the controller. It is powered by a 9V battery source. The temperature sensor and the soil moisture sensor are connected to the micro-controller using jumper wires. The relay module is used to control the solenoid valve. The control signal for the solenoid valve is provided through the micro-controller. Once the setup is complete, the next step is to link the device with the IoT application that is installed in the smartphone. The smartphone then sendsthe control signals that control the on and off functions of the solenoid water valve. It can be seen that the entire setup is simple, compact and very user friendly.

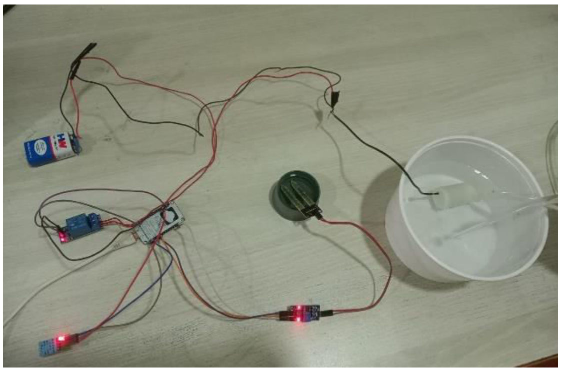

Fig 8: Hardware Connections

7 Software Output:

The application installed in the android smartphone displays the parameters like soil moisture, temperature and humidity. This helps in monitoring the current condition of the plant. A button is displayed with which the solenoid water valve can be controlled. When the moisture level falls below 600 or when the temperature rises beyond normal room temperature, say 30 degrees the water valve is turned on by clicking the button.

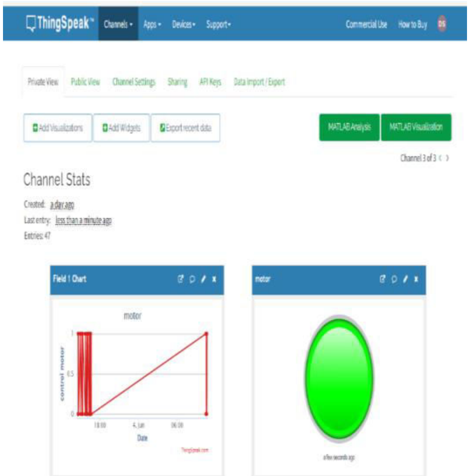

Fig 9: Results obtained through Mobile application. Once the temperature and soil moisture levels are back to normal values, it can be turned off by clicking on the same button.

8. CONCLUSION:

This whole project mainly focuses on two results. The first result is to help farmers to upgrade their agriculture – technical knowledge, act in accordingly with minimum requirements on environmental issues and mostly the basic function being prevented by major disasters and protect plants and nature from being ruptured. And the second result of our project is to use technology to measure the humidity, temperature and moisture of the plant root and make the plant grow in a well suitable environment with out the use of soil as per the concept of hydroponics. The farmer or user receives the message regarding the status and thus helps in avoiding delay of plant watering and protect the plant to live in a suitable environment.

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