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. 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. 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.*

1. 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 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, Sadman Sakib 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] Nivesh Patil, Shubham Patil, Animesh Uttekar, A. R. Suryawanshi have explained about Computers or mobile applications to control the system. In their system, every node is integrated with various devices, sensors and they are interconnected to one central server via wireless communication modules. Server role is to transmit and receives information from user end using internet connectivity. In system there are 2 modes of operation; manual mode and auto mode. In auto mode system takes decisions automatic and controls the devices installed whereas in manual mode user has freedom to control the operations of system using PC commands or android app. Mentioning the trends and chances for development for IOT in farming rural and sector development. Analyzing the knowledge obtained and proposing right steps of confirmation by establishing correct prototypes of model solution for hardware parts and software of IOT.

[4] Asif Siddiq, Annum Zehra, Muhammed Owais Tariq, Salman Malik have designed ACHPA, a sensor based system for automatic environmental control in hydrophonics. ACHPA controls environmental parameters i.e. temperature, humidity and soil moisture using sensors placed at convenient distances and a centralized controller to achieve a controlled environment for the production of crops. The operational ranges of the environmental parameters to be controlled are pre-fed in the controller. Environmental parameters received from the sensors are than compared with the pre-fed values for controlling action.

[5] Divya D, Harsha Mohan Hiremath, Jyothi T U, B S Shubhashree have designed a system. In the proposed system flow rate, pH and air quality sensors are used to measure different parameters. Flow rate sensor is used to measure the total amount of water and nutrient solution that is required in the hydroponics system to maintain the set pH value which is measured by the pH sensor, the system mainly focuses on automatically maintaining the pH value of the solution in reservoir by comparing the sensed value and the fetched value from an app. The air quality of the surrounding in which the system is installed is continuously monitored by the air quality 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 BLOCK DIAGRAM :

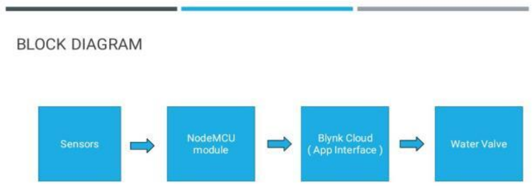

Fig 1: Block Diagram of the System

3.2 CIRCUIT DIAGRAM:

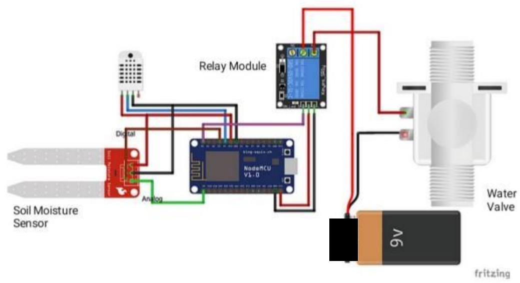

Fig 2: Circuit Diagram of the System

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.

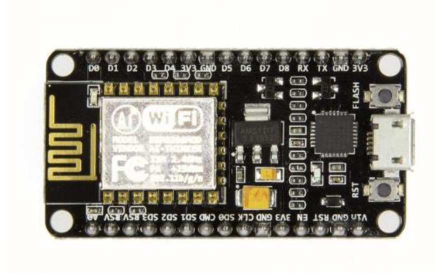

Fig 3 : Node MCU

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.

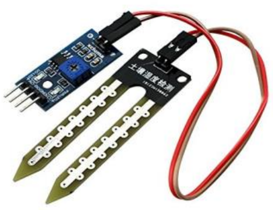

Fig 4: Soil moisture sensor

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 5: Relay module

4.4 Solenoid Water valve:

A solenoid dosing pump is a form of positive displacement pump which uses a diaphragm and solenoid assembly to displace the fluid into the discharge line. The solenoid 'drive' consists of an electromagnet and spring assembly, which is activated/deactivated with a series of electrical impulses.

Fig 6: Solenoid Water valve

4.5 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.

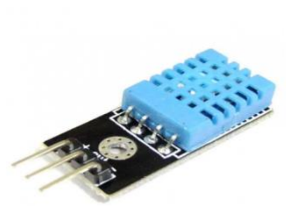

Fig 7: DHT11 sensor

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 8: Arduino Logo

5.2 BLYNK App:

Blynk app is an open source android application that can be used to build IoT applications in 5 minutes. It works with Arduino, ESP8266, ESP32, Raspberry Pi etc. It can be used to control these micro-controllers with the smartphone over the internet. Bluetooth and BLE is supported too.

Fig 9: Blynk App Logo

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. Sending alert messages to the user using Wifi module
8. Go to step 3

6.1 FLOW CHART:

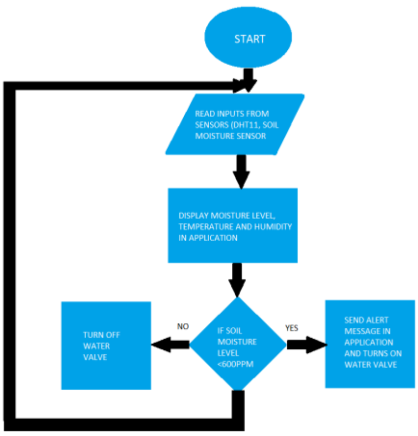

Fig 10: Flowchart of the System

7. RESULTS:

The Output of the proposed system is fast, accurate and secure. Hence, the experimental results show that the proposed system is easy to access and protects the plant from being rotten or drought.

7.1 Hardware Output:

The hardware setup of the system includes Node-MCU 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 sends the 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.

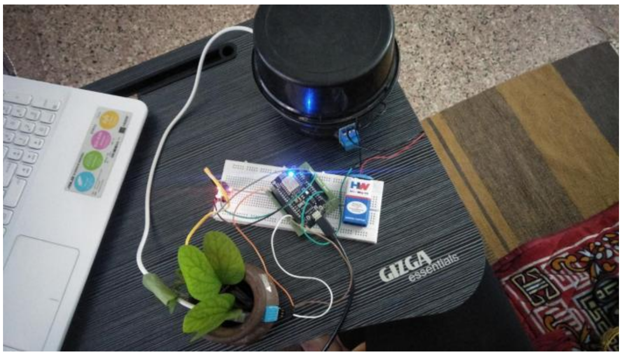

Fig 12: Hardware Design

7.2 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 11: 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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