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An Internet of Things (IoT) Based Smart Home Monitoring and Control System

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Abstract- The domain of Agricultural Engineering is only one of several that relies heavily on technological progress. A greenhouse is defined as a man-made structure with the express purpose of creating an artificial environment in which plants may be more closely monitored and regulated. In addition, the outcomes from these plants are superior to those from plants grown in the open air. On the other hand, there has been little adoption of internet-based greenhouse monitoring systems. This is the foundation for making use of the internet in a greenhouse system that can be remotely monitored over an internet network with the help of the Blynk app for Android. All that's needed to utilise these prototype systems is a web browser, an Internet-connected mobile device, and a Blynk account.

Keywords- Green House Effect, LDR sensor, Node MCU ESP8266, Temperature & Humidity sensor (DHT11).

I. INTRODUCTION

Farmers may maximise their productivity by using technology in agriculture. As a result, there has been a surge in the development of agricultural technology. Using a network connection to run a greenhouse monitoring system is one possibility.Using Internet of Things (IoT) technology, Shah and Batt (2017) created a working model of an affordable system that allows users to control and monitor greenhouse conditions. Users found the prototype system that (Anthony, 2017) created to be useful for reducing water and energy use as well as plant growth and load. All that's needed to utilise these prototype systems is a web browser, an Internet-connected mobile device, and a Blynk account. As an alternative to the complex and easily-aged 485 bus or CAN bus, a system was created in (Liang, He, Chen, & Du, 2018) that collects environmental data from greenhouses using a Wi-Fi module. Sensors in all three of these monitoring systems are always collecting data and relaying it to the microcontroller. To eliminate the need for human oversight, these sensors were installed in the greenhouse. Soil moisture sensors are essential for controlling the amount of water that plants get from irrigation systems because they measure the amount of moisture in the growth medium. In order to detect any specific change in the greenhouse's environment, temperature and humidity sensors are used. Optimal conditions for plant development may be maintained with the help of the data provided by these sensors. Prior research by Marliyanti (2018) tracked environmental factors in a greenhouse, including soil moisture, light intensity, temperature, and relative humidity (RH). The plants studied were red spinach (Amaranthus tricolour), an attractive annual plant with rapid growth and vibrant coloration. With the use of an internet network, the author of this research hoped to create a comparable monitoring system that could be operated remotely.

Using the Blynk app for Android devices based on the Microcontroller Node MCU ESP8266, the monitoring system technology keeps tabs on the greenhouse's temperature, humidity, soil moisture, and light intensity over the internet.

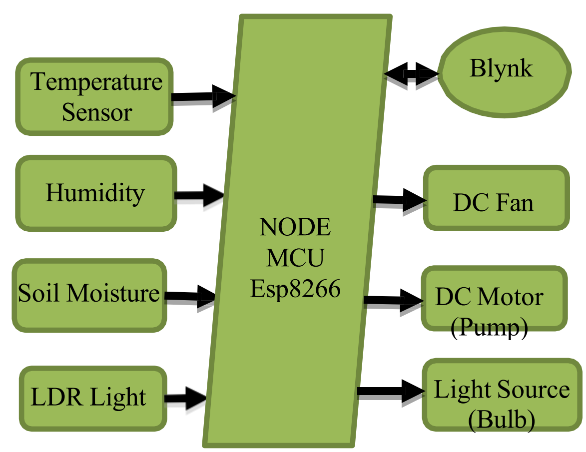

Figure. 1: Block Diagram of Greenhouse Monitoring and Controlling System

II. METHODOLOGY

To develop a wide variety of plants in a controlled environment, a greenhouse system must be well-versed in all relevant factors, including temperature, humidity, light concentration, and soil moisture. We must so constantly keep an eye on the humidity, light, and temperature. In order to keep tabs on every aspect of the greenhouse at all times, we have installed a DHT11 humidity and temperature sensor, an LDR light sensor, and a soil moisture sensor. For the framework, NodeMCU has been the principal device for storing and processing data from the aforementioned sensors. We made it easy to monitor and manage the greenhouse information by installing the BLYNK app on our mobile phones. The suggested architecture begins with the DHT11 sensor sending continuous humidity and temperature readings to the Node MCU. The next step is for the Node MCU to compare the current data to

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Vol 15, Issue 1, 2021

predetermined thresholds. In the event that As long as the continuous parameters remain below the edge value, nothing will change. However, if the qualities exceed the limit, the Node MCU will send a signal to activate the fan. This procedure is repeated for the soil moisture and LDR sensors. Temperature plus (humidity times 0.1) is the threshold value. By just staring at these electrical devices, we can maintain the required air pressure within the greenhouse whenever the Threshold value exceeds. In addition, it is how we maintain the temperature and humidity in the enclosed greenhouse. The BLYNK app is used to provide the consumer with the data collected by this sensor. The cycle is taken over by Node MCU, which is the central node of the whole system. Node MCU comes to life and cycles the required activity if sensors detect any change in soil or climate. In the event that the soil moisture sensor does not pick up any moisture in the soil, the Node MCU will activate the water syphon and display the engine condition on the LED. Additionally, the Node MCU assumes control and activates the light bulb in the event that the LDR sensitivity is low. A 16×2 LCD is used in this system to display the status of all operations, such as the motor's on/off status, temperature, humidity, and light status. The Blynk app is also linked with the status alarm so that the owner may get a message.

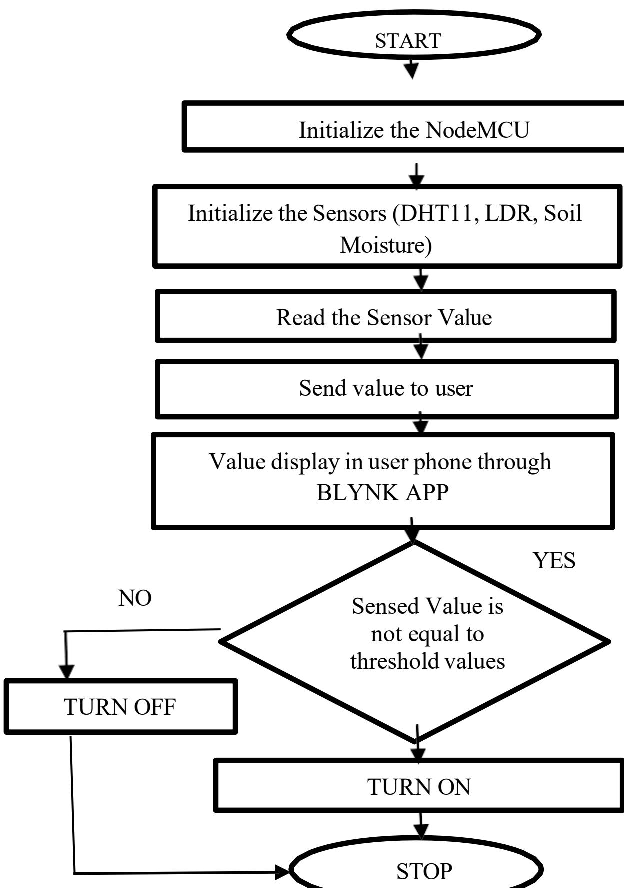

Figure. 2: Flowchart of the proposed system

The flow chart of this system is shown in Figure. 2, which explains all the operations in the sequence by using the blocks. Helps in a better understanding of the working of this system. This flow chart describes the project flow, from initializing the NodeMCU, the sensors (DHT11 sensor, LDR Sensor, Soil Moisture Sensor) and reads the data from the environment, the read value sent to the consumer's smartphone through BLYNK APP. All the value gets display in the user phone through this BLYNK APP. Through BLYNK APP user can control the functions.

III. SYSTEM ARCHITECTURE

A. HARDWARE USED

NODEMCU

Node MCU is a microcontroller with an ESP8266 Wi-Fi module that allows it to link to the internet. It is a software and hardware development board with open-source firmware. Node MCU has 4MB of flash memory and 128KB RAM to store data and programs. It has a 3.3V operating voltage. It can be programmed using Arduino IDE. It has a high baud rate of 115,200. The Node MCU has 17 GPIO (General Purpose Input/Output) Pins in which 10 pins are digital and only 1 pin is analog. Here Node MCU is used to read Inputs from the Sensors used (Soil Moisture, LDR, and DHT11 for Temperature & Humidity) and provide the appropriate output.

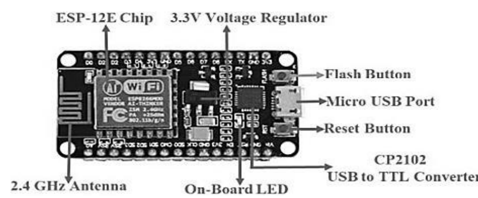

Figure. 3. Node MCU

TEMPERATURE & HUMIDITY SENSOR (DHT11):

The primary function of this sensor is to determine temperature and dampness and to change mechanized sign yield. It provides superior grade and excellent overall course of action efficiency by using the pushed sign five-star affirming technique, temperature, and tenacity seeing movement. The sensor joins a resistive-type drenched quality assessment part and an NTC temperature assessment piece, and connects with a ruling 8-digit microcontroller, offering inconceivable quality, speedy response, adversarial beyond what many woul asonableness.

Figure 4. DHT11 Temperature & Humidity Sensor

SOIL & MOISTURE SENSOR:

The soil moisture sensor is used to check the amount of moisture in the soil in which it is placed. This sensor is composed of two tests to go current through the dirt, and afterward, it peruses that protection from acquiring the moisture level. Whenever more water is available, it makes the dirt lead power effectively which implies, for

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Vol 15, Issue 1, 2021

example, less opposition while dry soil leads to less power for example more obstruction.

Figure. 4. Soil Moisture Sensor

LDR LIGHT SENSOR (LDR):

LDRs (light-dependent resistors), also known as photo-resistors, have resistance values that vary by many orders of magnitude depending on how much light falls on their surface. This resistor works on photoconductivity principle. When light falls on the LDR, the resistance decreases, allowing it to switch OFF a light, and when the LDR is in darkness, the resistance increases, allowing it to switch ON a light.

Figure 5: LDR Light

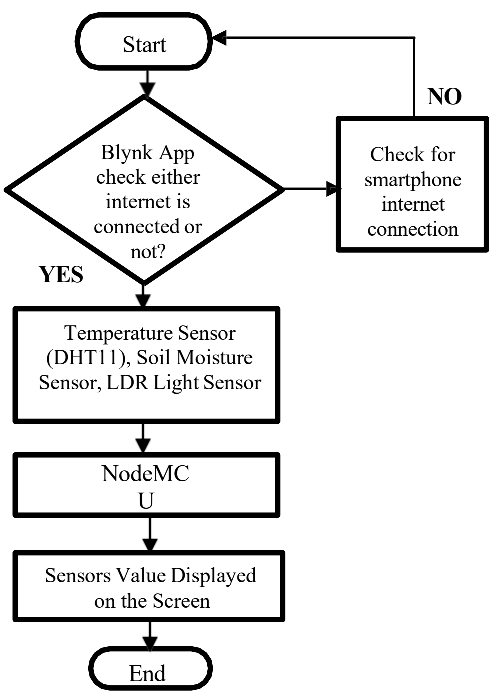

Figure.7. Flow Chart of Blynk App

B. SOFTWARE USED

BLYNK APP:

Blynk is a Platform with iOS and Android applications to control Arduino, Raspberry Pi over the Internet. It was intended for the Internet of Things. It can control hardware remotely, show sensor information, store information, visualize and numerous different things. In this project, we are controlling LEDs using Blynk App and Esp8266. In **Error! Reference source not found.**8., the functioning of the Blynk app is explained, initially, it checks for the internet connection, if not connected to the internet it goes again to the start and if the internet is connected it goes to the Sensors (DHT11 Temperature & Humidity Sensor, Soil Moisture Sensor and LDR Light Sensor). Then after the sensors, Node MCU is initialized to check the value of the sensor and it displays the values on the LCD screen in the Blynk App

Error! Reference source not found.**8. Blynk app.**

IV. RESULTS AND ANALYSIS

TABLE 1: Comparison of the Proposed System with some Recent Works

Reference No.	Temperature Sensor	Humidity Sensor	Soil Moisture Sensor	LDR Light Sensor	Node MCU Esp8266 Wi-Fi Module	Operation – Continuous
[6]	✓	✓	✓	✓	×	Not Possible
[9]	✓	✓	×	✓	✓	Not Possible
[13]	✓	✓	✓	✓	×	Not Possible
[14]	✓	✓	×	×	×	Not Possible
Proposed Work	✓	✓	✓	✓	✓	Possible

The TABLE 1. above delineates how the proposed framework offer controlling and monitoring alongside all potential parameters in examination with ongoing works identified with the nursery framework by other researchers. All these factors together were not proposed before. The framework has been tried under a recreated climate effectively. It portrayed the capacity of monitoring and controlling the light, moistness of the air, and inside temperature and dampness level of the soil altogether.

Figure. 6: Sample Screen containing data of the working

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Vol 15, Issue 1, 2021

A built-in LCD displays the calculated benefits of several environmental factors, including as temperature, humidity, soil moisture, and light intensity. Accurate and interference-free communication between the Node MCU Esp8266 Wi-Fi Module and several sensors has been observed. Figure 6 displays an example of the user's device screen when using the Blynk app. Using the Blynk App, the user's mobile displays the greenhouse data accurately. Both the Light and the Pump's actuator status is shown. The screen displays the current state of the device, including whether it is in auto or manual mode, along with the status of each LED.

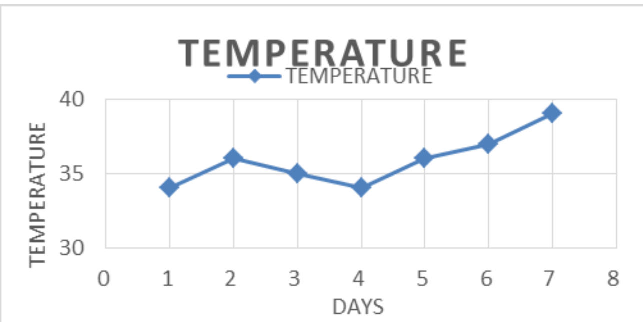

Figure. 7: Temperature data of greenhouse for various days at same time

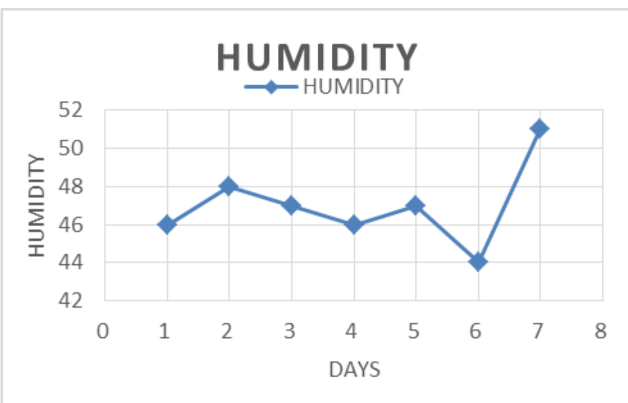

Figure. 8: Humidity data of greenhouse for various days at same time

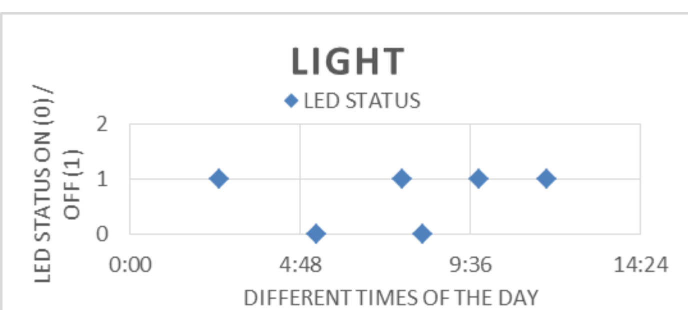

Figure. 9: Light status of greenhouse at different times of the

Graphical representations of temperature and humidity at a certain time (10:30am) are shown in Figures 7 and 8, respectively, for seven days of the week. The framework was tested throughout the day to ensure that the LED state, shown in Figure 9, accurately reflects the greenhouse light intensity. The light status may be either ON(1) or OFF(0). The data from the database is used to construct the graphics. With the use of sensors and solar energy, we were able to effectively upgrade our greenhouse monitoring and control system.

CONCLUSION

A completely operational Greenhouse Automatic Monitoring and Controlling System has been constructed after careful examination of all goals. In order to improve greenhouse crop and plant production, the suggested system employs three sensors to measure temperature, humidity, soil moisture, and lightning conditions. To analyse the data in an affordable way, we built a system that relies on databases connected to the Internet of Things (IoT). Depending on the fertilisation needs of the crops, it is possible to adjust the Threshold values. This system has the potential to evolve into a multi-controller setup in the future, allowing for the simultaneous automation of several greenhouses by a master controller and its slave controllers. Utilising Smart Greenhouse, farmers can cultivate crops in an environment that is cognizant of both climatic change and nutritional needs, leading to improved harvest quality. In order to help farmers make the most of their resources, the collected data is used to determine energy usage. Track, Manage, Automate, and Identify the Development of Plants. In order to control the environment for greater yield, monitor parameters for anomalies, and save power, water usage, and energy, it is a powerful tool.

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