IPEC Journal of Science & Technology, Vol. 01 (02), Oct. 2022

ISSN: 2583-3286(Online)

Greenhouse Monitoring & Control System using Node MCU ESP 8266

Sunidhi Goel, Nishu Tyagi, Anjali Yadav, Shraddha Goel, Garima Gupta
Department of Electronics and Communication Engineering, Inderprastha Engineering College, Ghaziabad, INDIA

***Abstract*- Technological advances play a vital role in all fields that include the realm of Agricultural Engineering. The greenhouse explicates as a constructed building that functions to manipulate the desired environmental conditions so that plants will be more controlled. Also, these plants provide more optimal results compared to plants that are cultivated outside the greenhouse. However, the use of internet technology in greenhouse monitoring systems is still limited. Based on this, to utilize the internet by creating a greenhouse system that can be monitored remotely with an internet network using the Blynk application on Android. The user of these prototype systems must have a mobile device with Internet access and a web browser connected to a Blynk account.**

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

I. INTRODUCTION

The utilization of technology in agriculture can optimize the performance of farmers. Hence, technology in the realm of agriculture is increasingly being developed. One approach is by utilizing the internet network to conduct a monitoring system in a greenhouse.(Shah & Batt , 2017) developed a prototype of a cost-effective system using Internet of Things (IoT) technology that enables people to monitor and manage growing conditions inside the greenhouse. (Anthony, 2017)developed a prototype system that was perceived by the end-users to be helpful in terms of water conservation, energy conservation, plants growth, and load conservation. The user of these prototype systems must have a mobile device with Internet access and a web browser connected to a Blynk account. In (Liang, He, Chen, & Du, 2018) developed a system that performed software and hardware design of greenhouse environmental information collection based on the Wi-Fi module to replace 485 bus or CAN bus that is complicated and the lines are easy to age. These three monitoring systems use sensors that continuously work and send information to the microcontroller. These sensors were placed in the greenhouse as a replacement for manual monitoring. One used to detect the moisture content of the growth media is a soil moisture sensor, which is necessary to control sufficient irrigation water for the plant. Temperature and humidity sensors are used to sense any particular change in the atmosphere inside the greenhouse. The information given by these sensors will be used as a reference to maintain an optimum environmental condition for plant growth. Previous studies by (Marliyanti, 2018) monitored temperature, relative humidity (RH), light intensity, and soil moisture inside a greenhouse with red spinach (Amaranthus tricolor, is a pretty annual that grows quickly and provides brilliant color) planted in polybags. In this study, the author aimed to design a similar monitoring system, by using an internet network, therefore, the monitoring system can be conducted remotely.

Date of Submission: 03 June 2022, Accepted on 1September 2022
Corresponding Author: Garima Gupta
(Email: garima1204@gmail.com)

The monitoring system technology monitors the temperature, humidity, soil moisture, and light intensity inside the greenhouse via the internet using the Blynk application on Android smartphones based on Microcontroller Node MCU ESP8266.

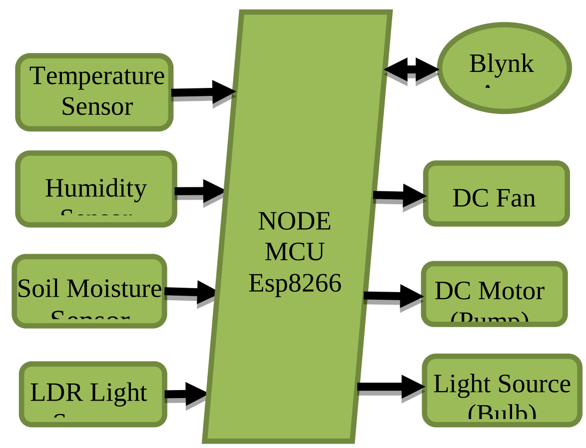

Figure. 1: Block Diagram of Greenhouse Monitoring and Controlling System

II. METHODOLOGY

To make a successful greenhouse system, all parameters such as temperature, humidity, light concentration, and moisture of the soil must be familiar so that diverse plants can be cultivated flawlessly. Thus, continuous monitoring of temperature, light, and moisture is significant. We have used a humidity and temperature sensor (DHT11), light sensor (LDR), soil moisture sensor to monitor all the greenhouse parameters continuously. The primary device that we have used for the framework is NodeMCU to save the data collected by the sensors mentioned above and to practice the data. We installed a BLYNK APP on our mobile phones to monitor and control the greenhouse information easily.

In the proposed framework, at first, the DHT11 sensor will happen and quantify the constant upsides of temperature and moistness which is sent to Node MCU. Now, Node MCU will compare these real-time values with preset threshold values. On the off chance that

ISSN: 2583-3286(Online)

the continuous parameters are under edge esteem, there will be no change except for assuming the qualities are over the limit, Node MCU will provide the order to turn on the fan and the same process will continue for the soil moisture and LDR sensor.

Threshold value = Temperature + (Humidity*0.1)

On the off chance that the Threshold esteem surpasses, the electronic gadgets are naturally turned ON, so we can keep up the necessary air inside the greenhouse by gazing at these electronic gadgets. Furthermore, through that, we are keeping up dampness and temperature in the shut greenhouse. The data gathered from this sensor is given to the customer through the BLYNK App. In this framework, Node MCU is the core of the entire framework that assumes responsibility for the cycle. When sensors sense any adjustment in climate or soil, Node MCU comes in real life and cycle the necessary activity. When the soil moisture sensor doesn't detect any dampness in soil then Node MCU turns ON the water siphon and makes an impression on the LED status that the engine is turned on. Furthermore, if LDR faculties low light, Node MCU takes control and turns on the light bulb. In this framework a 16×2 LCD is utilized for showing status for all activities like Motor turned on or off, temperature, moistness, and light status. Blynk application is likewise associated for message alarm of the status to be shipped off the proprietor.

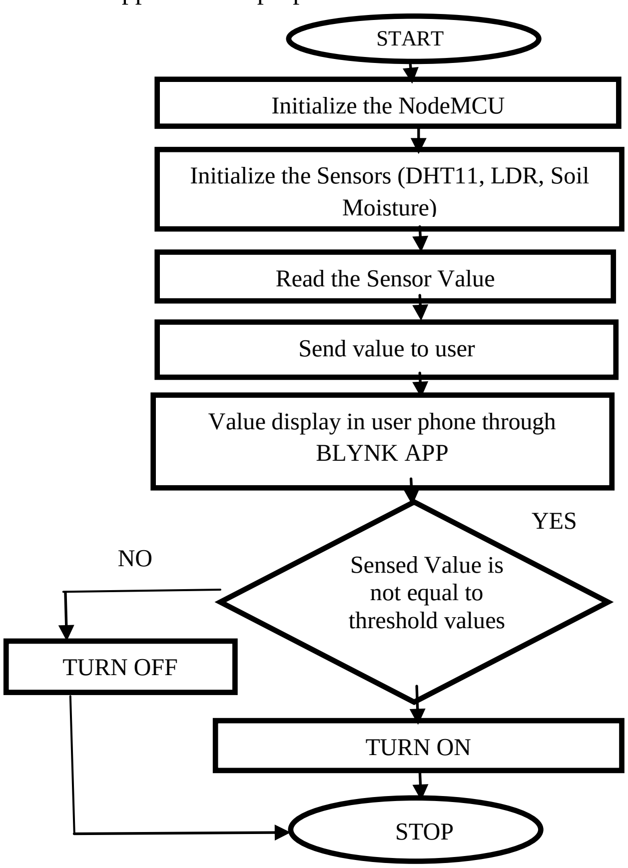

Figure. 2: Flowchart of the proposed system

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.

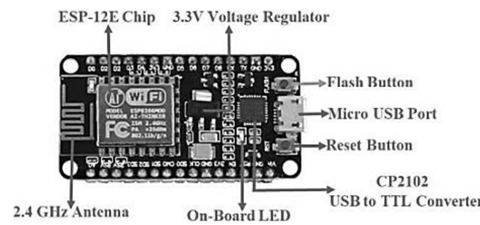

Figure. 3. Node MCU

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.

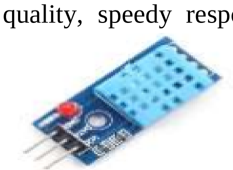

Figure 4. DHT11 Temperature & Humidity Sensor

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

ISSN: 2583-3286(Online)

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

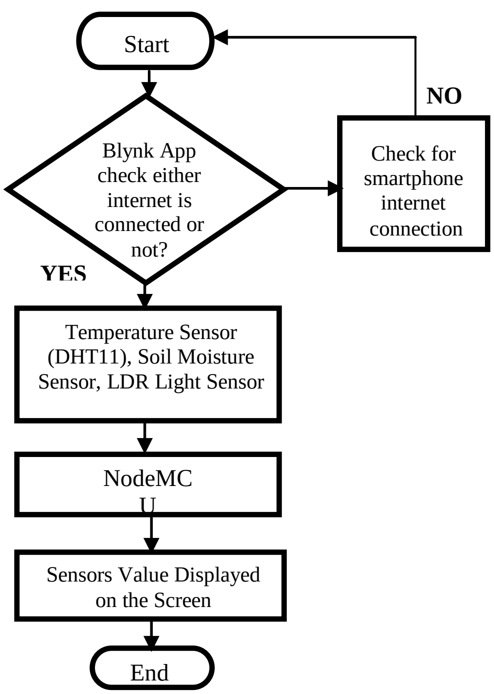

Figure.7. Flow Chart of Blynk App

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

ISSN: 2583-3286(Online)

The upsides of different boundaries like temperature, moistness, soil dampness, and light force are estimated effectively, and the deliberate qualities are shown on LCD that is appended with the framework. It is observed that the communication between Node MCU Esp8266 Wi-Fi Module and various sensors is done accurately without any interference. Figure. ***6***. shows a sample screen of the Blynk application on the user's device. The values from the greenhouse are perfectly shown over the Blynk App on the user's device. The situation with the actuators is displayed for the Pump and the Light. The screen shows if the gadget is in auto or manual mode and appropriately the situation with every one of the LEDs.

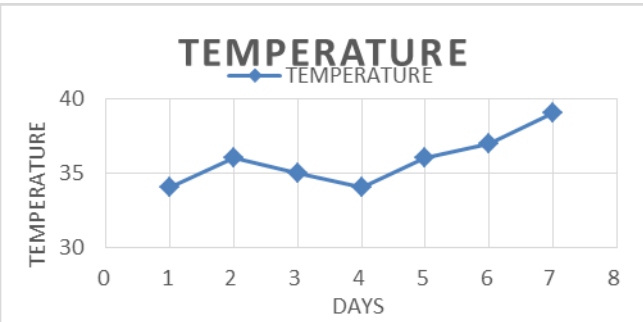

Figure. 7: Temperature data of greenhouse for various days at same time

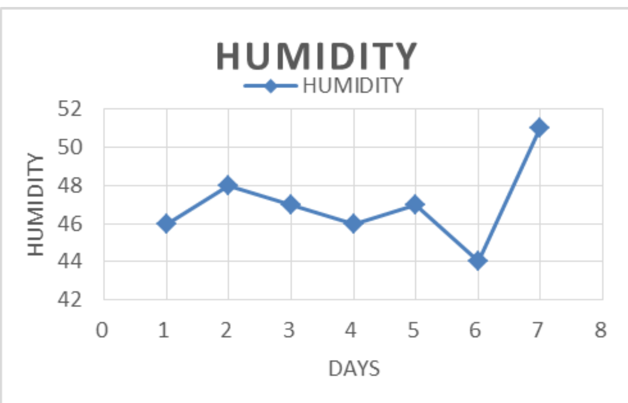

Figure. 8: Humidity data of greenhouse for various days at same time

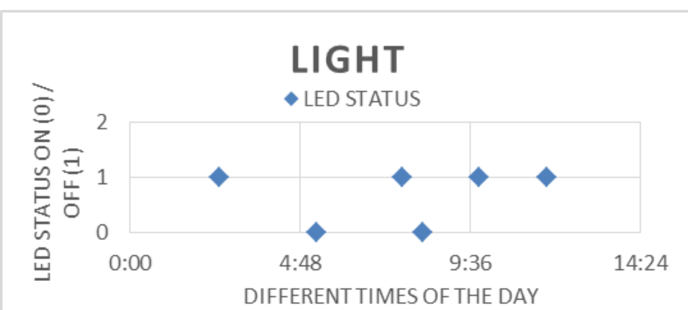

Figure. 9: Light status of greenhouse at different times of the

Figure. ***7***., Figure. 8, depicts the graphical representation of temperature and humidity respectively on seven different days of a week at a particular time (10:30am) for temperature and humidity. The framework was tested at different times of the day to check if the light intensity of the greenhouse is reflected on the led status, Figure. 9, represents the light status i.e. ON(1) or OFF(0). The graphs are created using the data from the database. The improvement of programmed greenhouse monitoring and controlling framework utilizing sensors and sunlight-based force is completed successfully.

V. CONCLUSION

After successfully studying all the objectives, we have built a fully functioning Greenhouse Automatic Monitoring and Controlling System. The proposed system uses three Sensors that determine the required parameters (Temperature, Humidity, Soil Moisture, and Lightning Conditions) for better crop/plant production inside the greenhouse. We developed a cost-effective system based on Internet of Things (IoT) databases to analyze the data. It allows changing the Threshold values according to the need for crop fertilization. In the future, this system can be a multi-controller system that will enable a master controller along with its slave controllers to automate multiple greenhouses simultaneously. Farmers can use Smart Greenhouse to create an environment for their crops that is both climate-smart and nutrition-sensitive, resulting in higher crop quality. The information gathered is used to calculate energy consumption, which assists growers in making the best use of their resources. Monitor, Control, Automate and Detect Plant Growth. It Monitors parameters for an anomaly, Controls the environment for better yield, Save power, water consumption and electricity.

REFERENCES

[1] Remya Koshy, M D Yaseen, K Fayis, Shaji Nisil, N J Harish and M Ajay, "Greenhouse Monitoring and Control Based on IOT Using WSN", ITSI Transactions on Electrical and Electronics Engineering, Vol. 4, No. 3, 2016.

[2] S.K.M. Mashhadi, H. Yadollahi, & A.M. Mashhad, Turk J Elec Eng & Comp Sci., vol. 24, pp. 2589 – 2608 (2016).

[3] Bhujbal, N., Sase, V. P., & Ratnaparkhi, M. R. (2015). Automated Green House Controller. International Journal on Advanced Electrical and Electronics Engineering (IJAEEE), 77-79.

[4] Bhujbal, N., Sase, V. P., & Ratnaparkhi, M. R. (2015). Automated Green House Controller. International Journal on Advanced Electrical and Electronics Engineering (IJAEEE), 77-79.

[5] D. Misra & S. Ghosh, International Journal of Environment, Agriculture and Biotechnology, 997- 1002 (2017)

[6] John Edgar S. Anthony, An Automated Greenhouse Monitoring System of Abiotic Factors for Leafy Vegetables Production in IRCHE 2017.

[7] MD Jiabul Hoque, Md. Razu Ahmed and Saif Hannan, EJERS, European Journal of Engineering Research and Science "An Automated Greenhouse Monitoring and Controlling System using Sensors and Solar Power" Vol. 5, No. 4, April 2020.