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Article Title: Renewable Energy Based Green House Environment Monitoring System Using IOT

Renewable Energy Based Green House Environment Monitoring System Using IOT

L. Shamini

UG Student, Department of Computer Science and Engineering, Rohini College of Engineering and Technology, Kanyakumari, India. shamiejam03@gmail.com

ABSTRACT

In greenhouses, plants like flowers and vegetables are grown. Daytime sunshine heats the soil, plants and structure itself inside greenhouses. Many farmers struggle to generate respectable income from greenhouse crops as a result of their failure to manage two essential factors that influence plant development and productivity. Temperatures in greenhouses shouldn't drop unless certain circumstances apply. The effects of high humidity include crop transpiration, water vapour condensation on various greenhouse surfaces and water evaporation from moist soil. These issues are addressed by the monitoring and management system for greenhouses. This study shows how to develop and use a variety of sensors for monitoring and controlling the greenhouse environment. The temperature and humidity sensors, soil moisture sensor, Node-MCU module and water pump are all part of this greenhouse control system, which is run by an Atmega328 microprocessor. The utilization of solar panels ensures constant power supply. Temperature and humidity in the atmosphere are measured through a DH11 sensor. The pumps turn on as the soil moisture sensor detects a reduction in the soil's water content. Monitoring and managing the system will be simple in this manner. The IOT module (ESP8266) receives data pertaining to these parameters at the same time. Regardless of any threshold mismatch identified, the data is delivered at regular intervals to IOT. The ESP8266 Node-Microcontroller, the DHT11 sensor, a solar panel and a soil moisture sensor are all used in this project. The Wi-Fi module built inside the microcontroller transmits the data to cloud database of the BLYNK app.

Keywords: Green house, Sensor, Blynk app.

1 Introduction

The Internet of Things (IoT) has significant applications in every facet of our life, including commerce, defence, security and health. We are aware that the majority of IoT node designs have energy limitations [1]. Using sensors, this system detects the presence of certain gases and several climate conditions, including temperature and humidity. A remote application or database can then receive the captured values [2]. The effects of CO and exhaust gases on atmospheric air pollution and global warming are common phenomena. In such cases, certain nations require healthful living and working environments in a facility and require ongoing environmental monitoring [3]. The Fourth Report of Intergovernmental Panel on Climate Change (IPCC) documents a 70% global increase in human-caused greenhouse gas emissions between 1970 and 2004 [4]. To create a greenhouse environmental monitoring and temperature forecast system that successfully realised the data acquisition end's lightweight design [5]. As automatic data acquisition technologies proliferated in the 2000s, such as RFID and sensor technologies, they were used to develop integrated environmental information systems (IEISs) and decision support systems (DSSs), as well as to revitalise environmental monitoring and management [6]. It is suggested that the iSoundIoT is a crucial instrument for ensuring acoustic comfort for improved living conditions and occupational health [7]. In order to transmit the monitoring data, the monitoring terminal often links to public networks and the closest base station. As a result, the network experiences anomalies since the continuous HMM signals are sometimes disrupted [8]. When IoT components are utilised to track and collect data using IoT-based devices, a potent tool for monitoring both indoor and outdoor environment is produced. Smoke, methane, liquefied natural gas (LNG), nitrogen-based gases, carbon-based gases, humidity and air temperature are among the important indicators that must be monitored and studied in order to have a complete awareness of the surrounding environment [9]. The Internet of Things enables communication and connection between people and things as well as between things and other things. It is an Internet-based technological advance. The Internet of Things is also equipped with intelligent processing capabilities that enable intelligent automatic control. [10].

The last part of the paper is organised as follows. Sections II and III, respectively, examine IoT's hardware and software designs. Section IV presents the system implementation process and its results. In Section VI, the paper is finished.

2 Recent Works

Omar Sedqi Kareem et al [11] it is proposed that the unpredictable weather brought on by climate change is to blame for the current worldwide food scarcity. Greenhouses can help with this problem since they significantly improve crop yields per unit of land area and provide a favourable climate for off-corps production. A wired sensor network can be used to manage and continuously monitor the environment in greenhouses, but its main drawbacks include its high cost, complicated wiring, fixed sensor positions and short range. To solve these issues, regulate greenhouse ambient temperatures and use a Wireless Sensor Network (WSN) based on Zig Bee technology, a real-time embedded system was created. The WSN is the greatest option for usage in greenhouses because to its advantageous characteristics, including its low cost, high reliability, long distances, excellent security and low power consumption. The built-in system is made up of basic parts. The brains of sensor node, an ATMEGA328P microcontroller and Zig Bee, gather data from numerous sensors and transmit it to a coordinating station so that it can be processed and stored. Actuators are then turned on or off based on the processed data. Real-time monitoring of the recorded data will be made possible. GSM technology was used in the development of the monitor system. The outcomes of the simulation demonstrate that the system is more effective at reducing labour costs and increasing

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Vol. 2(05), May 2023, pp. 26-35

the economic value of goods. The designed technology is very straightforward and quick to install.

Shennes Mathew [12] et al it proposes that a variety of technologies be used to monitor and control greenhouses. With the help of these technologies, plants can develop more quickly and produce more young plants. The project's main goal is to achieve this. Four sensors are used in this project: a humidity sensor, a temperature sensor, a light sensor and a soil moisture sensor. Temperature, light, humidity and soil moisture are all monitored using these four sensors. This project uses the most recent electronic technologies for an automated control system. The ARM 7 microcontroller and GSM phone are used in this project.one line. Because of the automatic working of this project it reduces the man power.

C. Suganthi Evangeline [13] et al The development of a greenhouse monitoring system (GHMS) that aids the grower in monitoring the environment and regulating sensor values via a feedback mechanism is the project's stated goal. The system combines six sensors to provide information about the environment, including humidity, temperature, obstacle entry, moisture content, light and pH. Sensor data is evaluated and sent to cloud using a Wi-Fi module, enabling online monitoring, showing sensor readings on a liquid crystal display (LCD) and sending alert emails and messages. Online databases and cloud both receive results and alter values. The greenhouse environment may be protected both online and offline with the help of this design for the grower. Additionally, it alerts the user if any animals or trespassers enter the agricultural area. Thus, the proposed effort takes into account the soil parameters, environmental factors and invader ingress. The GHMS project's proposed work offers a low-cost framework for sensing environmental variables like temperature, humidity, wetness, light and pH. An IR obstacle sensor is used to safeguard the greenhouse's surroundings from animal attacks. The cost-effective Global System for Mobile Communication (GSM) module is used to send messages and update the sensor values in the cloud. By transmitting messages, the requirement for a constant internet connection is eliminated.

Nagib Mahfuz et al [14] the creation of an intelligent system for monitoring and adjusting greenhouse factors is said to be the aim of this research. This cutting-edge equipment keeps track of crucial greenhouse farming variables like temperature, humidity, light, soil moisture and methane gas. These characteristics are tracked using integral sensors. The system will SMS the user a notification if the sensor value is outside of acceptable bounds. Several parameters' threshold values can be set using an Android app. The system is capable of autonomous operation as well as SMS user commands. On an LCD, the value of the on-site real-time sensor is displayed. The user's remote control will have access to multiple greenhouses. The device includes an optional data recorder system for statistics data and supplementary scientific study. This system will be essential for farming in greenhouses.

Revathi S [15] According to a theory put forth today, the world is sliding towards resource scarcity because of population expansion. This continuously puts strain on the environment

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and agriculture. In the end, this necessitates a fundamental shift in farming methods. By limiting major elements that influence plant growth, greenhouse cultivation has developed as a kind of controlled environment farming to increase yield. Making right management decisions is made possible by real time sensor monitoring of greenhouse environment, which can have a major impact on plant development, increase yields and boost economic performance. The primary elements of a controlled environment in a greenhouse are temperature and humidity. A theory put forth today contends that the world is heading towards resource scarcity as a result of population growth. The ecology and agriculture are continually strained as a result. This ultimately calls for a major change in farming practises. In order to increase crop yield, a type of greenhouse horticulture known as controlled environment agriculture has arisen. Making right management decisions is made possible by real time sensor monitoring of greenhouse environment, which can have a major impact on plant development, increase yields and boost economic performance. The Arduino is connected to the Internet of Things (IoT) platform 'Thing Speak', which is designed for data gathering and analytics. Increasing the user's versatility, Thing Speak serves as a link between edge node devices that gather data and data exploratory analysis software that examines data. It would allow for long-term online system performance monitoring from any location in the world.

3 Proposed System

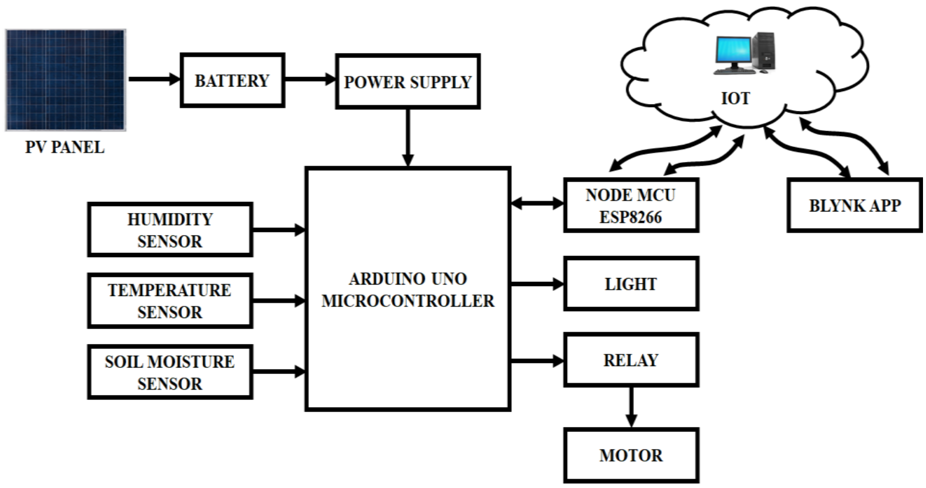

Figure 1: *Block Diagram of Proposed Work*

This paper suggests a system for monitoring the greenhouse environment that is based on the Internet of Things. To improve data processing in the cloud storage system, a microcontroller unit is created with a Wi-Fi module named NODEMCU. Blynk app, a cloud-based website, keeps track of and updates the user's information. The DHT11 sensor combines temperature and humidity sensors. Both a humidity sensor and an NTC temperature sensor are included in one sensor. PV panels are utilised to provide constant power. These sensors produce calibrated digital output with great reliability. The soil moisture sensors calculate the measured water

International Journal of Advanced Trends in Engineering and Management (IJATEM)
Vol. 2(05), May 2023, pp. 26-35

content of soil. It has two electrodes that are dipped into the ground and if the ground is moist, electricity can flow from one electrode to the other; otherwise, it produces a weak output. In this suggested system, a controller unit is interfaced with a 12V submersible pump motor. A 12v relay is connected to the water motor and controller unit for control and protection purposes. Using the Blynk app, users may regulate lighting. Relay functions in up usual condition and turns off the water supply. The Wi-Fi module built into the microcontroller transmits the data to the Blynk app's cloud database.

3.1 Arduino Microcontroller

Platform for open-source electronics Hardware and software in Arduino are simple to use. The ATmega328 microcontroller board is employed. In addition to having a reset button, it has a USB connector, a power jack, an ICSP header, a 16 MHz ceramic resonator, six analogue inputs and fourteen digital input/output pins. You only need a USB cable, an AC-to-DC adapter, or a battery to power the microcontroller; everything else is provided in package.

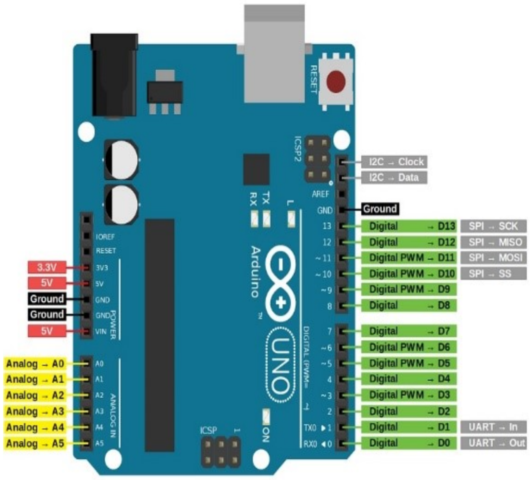

Figure 2: *Arduino Micro Controller*

3.2 Node MCU ESP8266

- For the open source Node MCU firmware, there are open source prototyping board designs available. The name "node MCU" (micro-controller unit) is a combination of the terms "node" and "MCU". The term "Node MCU" strictly speaking only refers to the firmware, not the associated development kits. Ten-silica 32-bit RISC CPU LX106 is the microcontroller.Operating Voltage: 3.3V.
- Input Voltage: 7-12V.
- Digital I/O Pins (DIO): 16.
- Analog Input Pins (ADC): 1.

International Journal of Advanced Trends in Engineering and Management (IJATEM)
Vol. 2(05), May 2023, pp. 26-35

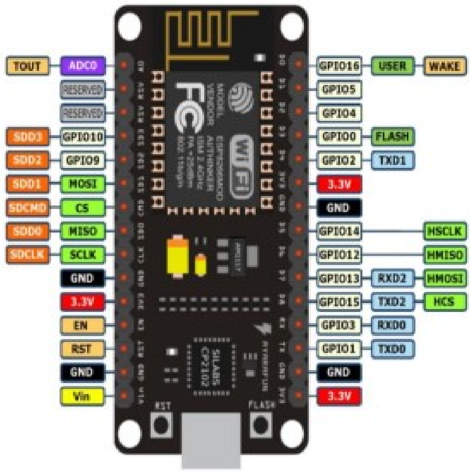

Figure 3: *Node MCU ESP8266*

3.3 Relay Module

Electrical switches known as relays that may be controlled by low voltages can be turned on or off, allowing current to flow or not.

COM: common pin

NC (Normally Closed): When choosing the generally closed option, you want the relay to be closed by default so that current won't flow unless a signal from the relay module instructs it to open circuit and halt current.

NO (Normally Open): The other way around is true of the normally open design.

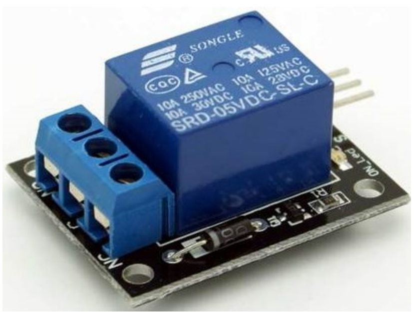

Figure 4: *Relay Module*

3.4 DHT-11 Sensor

A low-cost digital sensor that monitors humidity and temperature is called the DHT11. This sensor can swiftly detect temperature and humidity with the help of any micro controller. The monitoring of humidity and temperature in HVAC systems is just one application for this sensor's many uses.

International Journal of Advanced Trends in Engineering and Management (IJATEM)
Vol. 2(05), May 2023, pp. 26-35

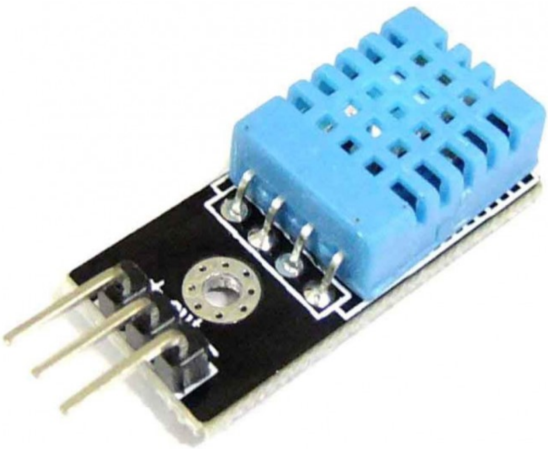

Figure 5: *DHT-11 Sensor*

3.5 Soil Moisture Sensor

The detected amount of soil water is calculated by soil moisture sensors. In this system, IOT is used to control and monitor the irrigation system. IOT is utilised to obtain real-time and stored data monitoring of diverse soil contents. Soil moisture sensors, which are also used to monitor the water content of soil, can be used to determine how much water is stored in soil horizons. Soil moisture sensors do not instantly measure the amount of water present in the soil. Instead, they monitor variations in a specific soil feature that is rationally related to water content. The soil moisture sensor allows the pumps to start as the water level drops. The bulb turns on as a result of the LDR sensor detecting a lack of light. This makes it simple to control and keep an eye on the system.

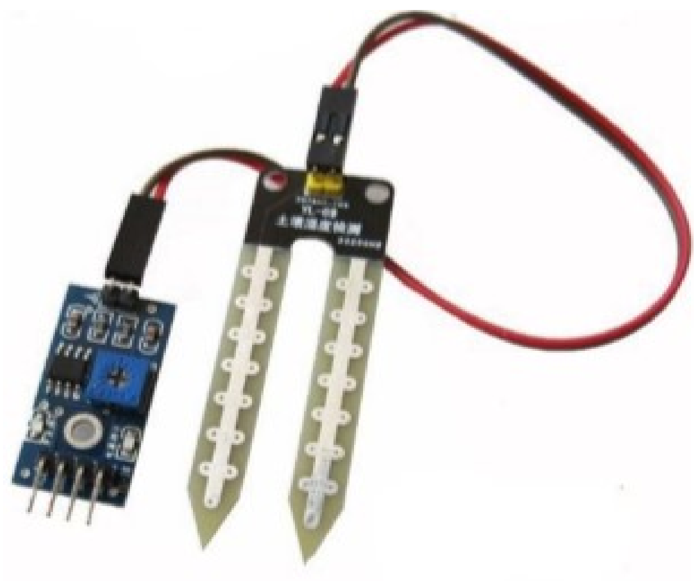

Figure 6: *Soil moisture sensors*

International Journal of Advanced Trends in Engineering and Management (IJATEM)
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4 Results and Discussion

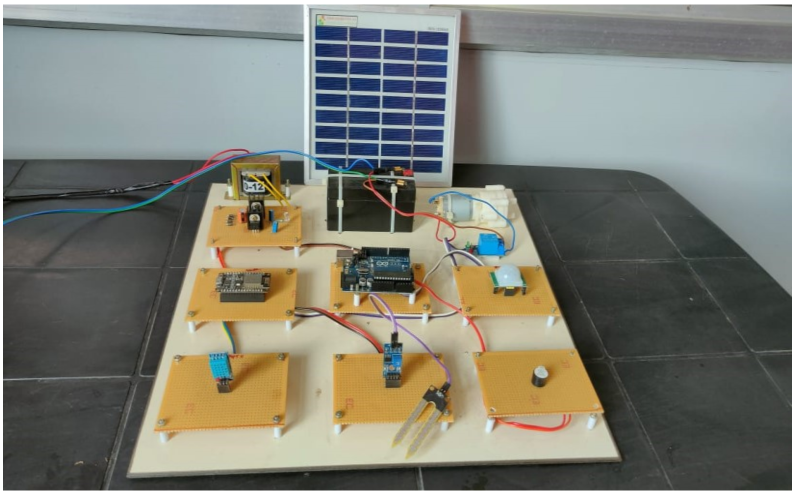

Figure 7: *Hardware setup*

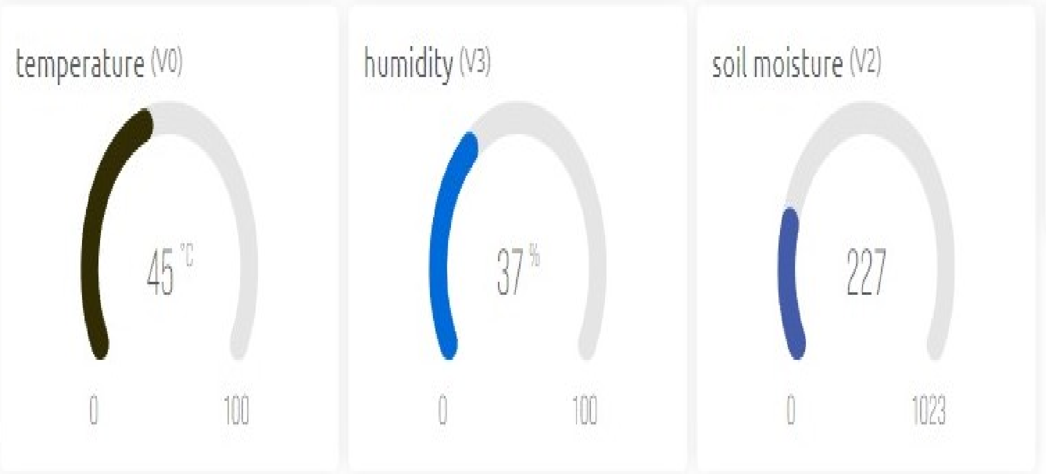

Figure 8: *Output using Blynk app*

The greenhouse monitoring system was implemented in hardware. The sensors were used to measure the variables taken into account for greenhouse monitoring and the data was updated on the website that was made specifically for it. For better monitoring and analysis, a real-time graph of the sensor values was also supplied on the customized homepage.

Additionally, the Blynk App offers outcomes in the form of numerous preconfigured widgets to display the sensor values. Figure 8 illustrates how the widget gauge was utilised to display the temperature and humidity.

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5 Conclusion

The ground is irrigated using a traditional approach with more water than the crop need. Water waste can be avoided with the use of modern irrigation systems. The most recent technology, however, significantly reduce the risk involved in agricultural production and offer effective water resources. The implementation of a cheap IoT-based smart irrigation system is the goal of this project. Blynk app, a cloud-based website, keeps track of and updates the user's information. The DHT11 sensor detects the volumetric water content of the soil while also measuring temperature and humidity. PV panels are used to supply the battery with constant electricity. In a typical situation, the relay turns on and cuts off the water supply. With the help of the Wi-Fi module the microcontroller has built in, the data is uploaded to the cloud database of the BLYNK app.

References

1. Said Omar; Zafer Al-Makhadmeh; A. M. R. Tolba, Year: 2020, "EMS: An Energy Management Scheme for Green IoT Environments", in IEEE Access, Vol: 8, pp. 44983-44998.

2. Mabrouki Jamal; Mourade Azrour; Driss Dhiba; Yousef Farhaoui; Souad El Hajjaji, Year: 2021, "IoT-based data logger for weather monitoring using arduino-based wireless sensor networks with remote graphical application and alerts", in Big Data Mining and Analytics, Vol: 4, no: 1, pp. 25-32.

3. Wang Yanfeng; Makoto Nishikawa; Ryuichi Maeda; Masaichi Fukunaga; Kenzo Watanabe, Year: 2005, "A smart thermal environment monitor based on IEEE 1451.2 standard for global networking", in IEEE Transactions on Instrumentation and Measurement, Vol: 54, no: 3, pp. 1321-1326.

4. Kumar Anuj, I. P. Singh, and S. K. Sud, Year: 2011, "Energy Efficient and Low-Cost Indoor Environment Monitoring System Based on the IEEE 1451 Standard", in IEEE Sensors Journal, Vol: 11, no: 10, pp. 2598-2610.

5. Geng Xia; Qinglei Zhang; Qinggong Wei; Tong Zhang; Yu Cai; Yong Liang; Xiaoyong Sun, Year: 2019, " A Mobile Greenhouse Environment Monitoring System Based on the Internet of Things", IEEE Access, 1–1.

6. Fang Shifeng et al., Year: 2014, "An Integrated System for Regional Environmental Monitoring and Management Based on Internet of Things", in IEEE Transactions on Industrial Informatics, Vol: 10, no: 2, pp. 1596-1605 2014.

7. Marques Gonçalo; Rui Pitarma, Year: 2020, "A Real-Time Noise Monitoring System Based on Internet of Things for Enhanced Acoustic Comfort and Occupational Health", in IEEE Access, Vol: 8, pp. 139741-139755.

International Journal of Advanced Trends in Engineering and Management (IJATEM)
Vol. 2(05), May 2023, pp. 26-35

8. Zheng Min; Shizhen Bai, Year: 2021, "Implementation of Universal Health Management and Monitoring System in Resource-Constrained Environment Based on Internet of Things", in IEEE Access, Vol: 9, pp. 138744-138752.

9. Hassan Mosfiqun Nahid; Mohammed Rezwanul Islam; Fahad Faisal; Farida Habib Semantha; Abdul Hasib Siddique; Mehedi Hasan, Year: 2020, "An IoT based Environment Monitoring System", 2020 3rd International Conference on Intelligent Sustainable Systems (ICISS), pp. 1119-1124.

10. Liu Yunpeng; Fei Xiao, Year: 2021, "Intelligent Monitoring System of Residential Environment Based on Cloud Computing and Internet of Things", in IEEE Access, Vol: 9, pp. 58378-58389,

11. Omar Sedqi Kareem; Noor Najeeb Qaqos, "Real-Time Implementation of Greenhouse Monitoring System Based on Wireless Sensor Network", Vol: 8, no: 2S2, pp. 215-219.

12. Shennes Mathew; Sarguna; Snekha; Kuberan; Rajesh, "Monitoring And Controlling Of Greenhouse Using Microcontroller", Vol: 118, no: 20, pp. 585-590.

13. Evangeline C. Suganthi; Ashmiya Lenin; Jaya Keshava Chandra; Jeeva Prasath, "Monitoring and Control of Vital Parameters in Greenhouse using Internet of Things",Vol: 8, no: 9, pp. 849-859.

14. Mahfuz Nagib; Rounak Jahan; Md Mominul Islam; Mehen Nigar; Shawan Karmokar, Year: 2020, "Microcontroller Based Intelligent Greenhouse Environment Monitoring and Controlling System", IEEE International Women in Engineering (WIE) Conference on Electrical and Computer Engineering (WIECON-ECE), pp. 481-421.

15. S. Revathi; L. Vineetha; K. Lakshmi Ramya; N. Sivakumaran, "Intelligent Monitoring and Control of Greenhouse Environment", International Journal of Engineering Technology Science and Research, Vol: 4, no: 6, pp. 707-713.