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IOT BASED GREENHOUSE MONITORING AND CONTROLLING SYSTEM

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ABSTRACT:

A greenhouse is a structure made mainly of transparent material, such as glass, in which plants are grown in a controlled environment. Traditional method of monitoring greenhouse involves human labour and is time consuming. The proposed system uses the concept of IOT (Internet of Things) and is much more efficient. The greenhouse environmental parameters are continuously sensed using various sensors and the collected data is displayed on a customized website. Thus, the greenhouse can be monitored from anywhere and at any time. The variation in individual sensor's data over time can be graphically plotted for improved monitoring.

Keywords: Internet of Things; Wi-Fi Module (ESP8266); Microcontroller (ArduinoUno); Sensors; Greenhouse Monitoring.

I. INTRODUCTION

A greenhouse is mainly used to grow certain types of plants throughout the year or plants that require continuous monitoring to achieve high quality and quantity. At present most of the greenhouses are manually controlled and monitored. This method of greenhouse monitoring is labour intensive and time consuming. The Internet of Things concept can be used in greenhouse to increase the productivity by using various sensors to sense the environmental parameters. The Internet of Things is a network of devices that are connected via internet and together with web services communicate with each other. This paper proposes a system to monitor and automatically as well as manually control the system in greenhouse using temperature sensor, humidity sensor, light intensity sensor and soil moisture sensor. If the sensed data crosses a predefined threshold range an alarm will be triggered which will alert the user. An overview of related research work has been presented in this section.

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Several authors have proposed using IOT concept in agriculture [1] and greenhouse [2]. K. Rangan and T. Vigneswaran [3] have described an embedded system approach for monitoring greenhouse based on parameters such as humidity, pH of water, wetness of soil, temperature and light intensity. These parameters are measured using sensors, processed, controlled and informed to the proprietor through Short Message Service technology using GSM modem. Prakash. H. Patil, Chaitali Borse, Snehal Gaikwad and Shilpa Patil [4] have developed a greenhouse monitoring system using GSM, which monitors the levels of temperature, humidity, light, and CO2. Their proposed system uses sensors and Short Message Service technology. The system offers a mechanism to alert farmers regarding the parameter changes in the greenhouse. However, both systems lack a real-time graphical representation of the measured data and the feature of controlling the greenhouse system remotely. This paper mainly aims to describe the greenhouse monitoring system which will display the sensed data on a webpage and will also provide the facility of controlling and monitoring the system remotely. The greenhouse monitoring system uses various sensors to sense the environmental parameters of the greenhouse. The parameters used to monitor the greenhouse are temperature, humidity, light intensity and soil moisture. The data collected from the sensors are send to the microcontroller for processing. The microcontroller is also connected to a Wi-Fi module which connects the system to the internet. After processing, the data is send over the internet to be displayed on a customize webpage.

II. DRAWBACK OF EXISTING SYSTEMS

The existing setups can be classified as shown below

Manual setup: This set-up involves visual inspection of the plant growth, manual irrigation of plants, turning ON and OFF the temperature controllers, manual spraying of the fertilizers and pesticides. It is time consuming, vulnerable to human error and hence less accurate and unreliable.

Partially automated setup: This set-up is a combination of manual supervision and partial.

Fully automated: This is a sophisticated set-up which is well equipped to react to most of the climatic changes occurring inside the greenhouse. It works on a feedback system which helps it to respond to the external stimulation efficiently. Although this set-up overcomes the problems caused due to human errors it is not completely automated and expensive. Global System for Mobile communications uses pulse based burst transmission technology and hence it interferes with certain electronics. Due to this fact airplanes, petrol bunks and hospitals prevent use of GSM based mobile or other gadgets. GSM provides limited data rate capability, for higher data rate GSM advanced version devices are used. It uses FTDMA access scheme. Here multiple users share same bandwidth and hence will lead to interference when more number of users are using the GSM service.

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In order to avoid this situation, robust frequency correction algorithms are used in mobile phones and base stations. The GSM technology is almost outdated. User interface of an IOT system helps the user to easily control the variables and monitor the changes. So, every IOT system requires a well-developed UI. By overcoming these drawbacks we implemented iot based greenhouse monitoring and controlling system. Now, we go for methodology. It describes the proposed system.

III. METHODOLOGY

The proposed system will give a smart solution for green house. It happens to implement the technology of internet of things along with the conventional systems available. We created a total model of sm greenhouse for implementing our system. Our System consists of simple but efficient algorithm, which happens to manage all the aspects. An ATmega328 microcontroller is used as the brain of the system. Here microcontroller is used because of its low cost and faster response to handle our system. To check the climate conditions of the green house, be measured. Microcontroller then measures the condition of soil moisture and waters the plants if the level is lower than usual Next it takes value of both temp and humidity, and takes air in or out and starts/stops the sprayers accordingly depending on the condition Temperature, humidity, soil moisture, light intensity are to. Then it determines Day or Night condition using LDR sensor. And at the end, all the data is sent to the user by sending a SMS using GSM to the mobile application by and to the server using GPRS. There's also a LCD display to show real time data.

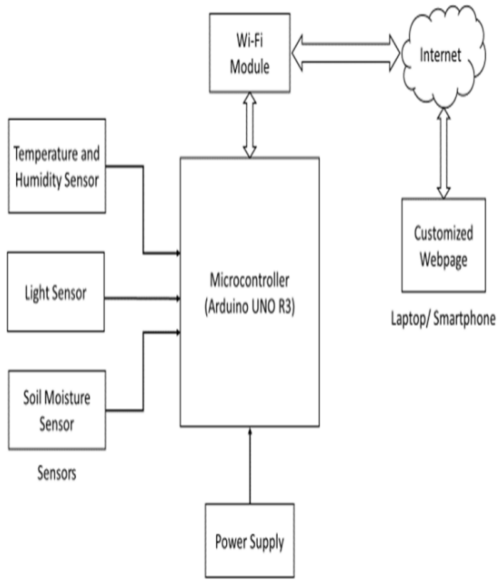

Figure 1: Block Diagram of the Greenhouse Monitoring and Controlling System

A. Sensors

DHT 11 sensor is used to sense both temperature and humidity of the greenhouse. It requires only a single analog pin to send both temperature and humidity data. A soil moisture sensor is used to sense the moisture content of the soil and it also uses an analog to send the data to microcontroller. The light intensity in the greenhouse is measured by using an LDR sensor module.

B. Microcontroller

The microcontroller used to design the greenhouse monitoring system is Arduino UNO R3. Arduino Uno is a microcontroller board based on the ATmega328P (datasheet).

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It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started [5].

C. Wi-Fi Module

ESP8266 Wi-Fi module is used to connect the greenhouse monitoring system to the internet. It is a low-cost Wi-Fi microchip with full TCP/IP stack and microcontroller capability produced by Shanghai-based Chinese manufacturer, Espressif Systems [6]. Due to its low price, it is the most popular Wi-Fi module used for Internet of Things projects.

IV. CLOUD IOT BASED GREENHOUSE

In this system the temperature sensor detects the current temperature value and inputs it to pin of the microcontroller. The input is an analog input and it is converted to a digital input and calibrated. Then it is displayed. Similarly, for humidity, moisture and Light sensor. The output values which is to be stored on to the cloud through Internet of Things (IoT) is first transmitted out of the microcontroller to GSM modem through USART (Universal Synchronous and Asynchronous Receiver and Transmitter). Level converters are used to match the voltage levels of the microcontroller and GSM modem.

Finally, the output parameters are logged on to the cloud network periodically.

V. OBJECTIVES

- Ease of accessing and simplicity on maintenance.
- Advanced connectivity of physical objects over a wide network.
- To maintain the history of parameter records Build miniature greenhouse which is equipped with automatic monitoring and controlling system.
- It focuses on saving water, increasing efficiency.
- The user can see the atmospheric conditions of the greenhouse plants on website and control the greenhouse from faraway places.
- Constantly monitor and control environmental conditions in greenhouse to ensure it remains at preset temperature, light, moisture and humidity levels.

VI. PERFORMANCE MEASUREMENTS

Following figures explain working procedures of our system. Figure 2 represents the model of our whole system.

In this model it will measure the environmental parameters by placing temperature humidity sensor, ldr sensor and soil moisture sensor. The environmental parameters can be monitored on the lcd display. The Internet of things (IoT) is the network of physical devices, which enables these objects to connect and exchange data

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Figure 2: system model

At figure 3, LCD showing the real-time data of

humidity and temperature. The fans take out air if temperature gets higher than 27° C and starts the heating system if temperature gets lower than 14° C. Also, greenhouses need high humidity conditions.

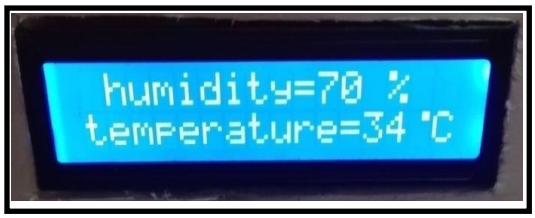

Figure 3: Real-time humidity and Temperature values

For maintain high humidity inside the greenhouse, the system turns ON the sprayers whenever it detects the humidity level inside the greenhouse goes lower than 90% and turns them OFF after achieving humidity level of 96%.

Figure 4: light intensity value

Figure 4 illustrates the condition of light intensity. If light intensity is lower outside, then it automatically turns ON the lights inside the greenhouse. Also turns them OFF if the ambient light intensity around the greenhouse becomes average.

VII. RESULTS

A hardware implementation of the greenhouse monitoring system was done. The parameters considered for monitoring the greenhouse were measured using the sensors and the data was updated on the customized webpage. A real time graph of the sensor values was also provided on the customized webpage which can be used for improved monitoring and analysis.

In result it will show the values of the environmental parameters such as temperature, humidity, soil moisture and ldr. The values may represent interms of graph in webpage and it display the values in android mobile phone.

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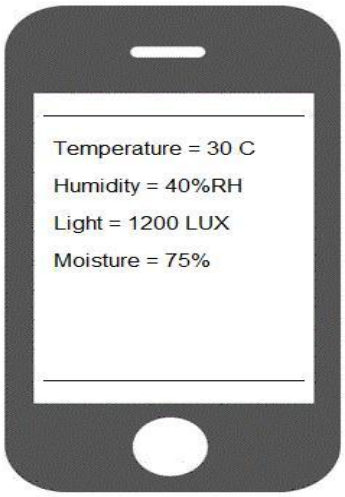

Figure 5: output in android mobile

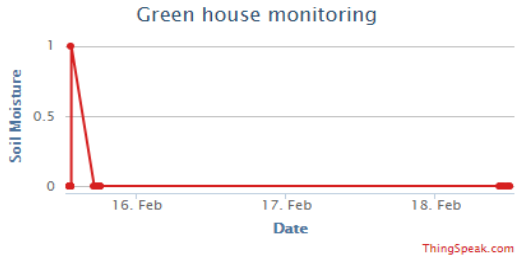

Figure 6: soil moisture graph

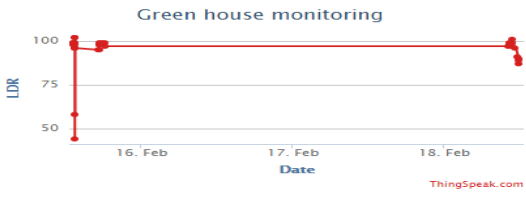

Figure 7: ldr graph

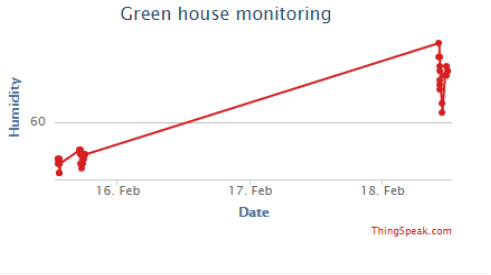

Figure 8: humidity graph

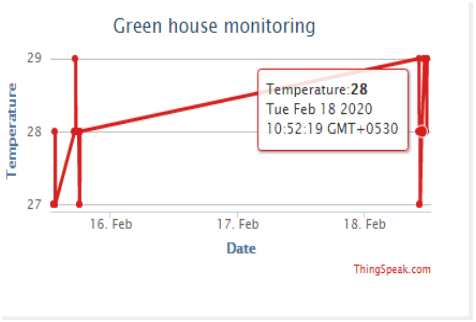

Figure 9: temperature graph

VIII. CONCLUSION

The proposed IOT based greenhouse monitoring system is a complete system designed to monitor and control the environmental parameters inside a green house. The traditional system for greenhouse monitoring is labour-intensive and time consuming. The proposed system saves time, money and human effort. It provides a controlled environment for the plants to prevent them from damage and thus increasing the overall produce. The smart greenhouse automatically controls the various parameters needed for the plants and sends the sensory data to a customized webpage for continuous and effective monitoring.

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