IoT Based Greenhouse Automation System

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Abstract

Traditional method of monitoring greenhouse involves human labor and is time consuming. Nowadays due to urbanization and lack of land availability there is a great need to construct the Greenhouses which will be reserved mainly for growing crops. With the advancement of technology we can control and monitor the multiple Greenhouses using IOT from the central location wirelessly.

Thus, the greenhouse can be monitored from anywhere and at any time. The microcontroller will automatically turn on the motor if the soil moisture is less than a particular value. The system will monitor the various environmental conditions such as humidity, soil moisture, temperature, presence of fire, etc. The greenhouse environmental parameters are continuously sensed using various sensors and the collected data is displayed on a customized website. The prototype was tested under various combinations of inputs in our laboratory and the experimental results were found as expected

Keywords—*greenhouse; IoT; microcontroller; soil moisture.*

I. INTRODUCTION

Greenhouses form an important part of the agriculture and horticulture sectors of a country. Green houses are used to grow plants in controlled conditions. These green houses are usually build in houses with glass or plastic in which plants will be grown in controlled conditions, and its productivity over IOT. Automated greenhouse involves the automatic monitoring and controlling of climatic parameters which directly or indirectly govern the plant growth and production. In order to control the climate factors and environment automatically we require a software and IOT to monitor it over internet. 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.

The modern proposed systems use the mobile technology as the communication schemes and wireless data acquisition systems, providing global access to the information about one's farms. But it suffers from various limitations like design complexity, inconvenient repairing and high price. Also the reliability of the system is relatively low, and when there are malfunctions in local devices, all local and telecommunication data will be lost and hence the whole system collapses. Moreover farmers in India do not work under such sophisticated environment and find no necessity of such an advanced system, and cannot afford the same. Keeping these issues in view, an IOT based monitoring and control system is designed to find implementation in the near future that will help Indian farmers

II. PROPOSED METHOD

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. A block diagram of the proposed system is presented in Fig.1.

The biggest disadvantage of these systems was that one person always had to be present in the green house or in the vicinity of the green house. The first problem which is overcome in our system is that a person need not always be present in the greenhouse. Plants in green house are grown under controlled environment. The temperature differences can cause harm to plants. Sometimes the farmers cannot predict which action needs to be taken so to control the environment and may take wrong decisions thus causing more harm to the plants in the green house. Our system will allow him to take proper decisions by providing the status of the sensors to the farmer with accurate information through the IOT web server. Thus this system helps farmer to control green house from remote locations.

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The basic block diagram of greenhouse system is shown. Micro-controller is used to obtain values of physical data through sensors connected to it. And then sensor's collected data is given to Wi-Fi module.

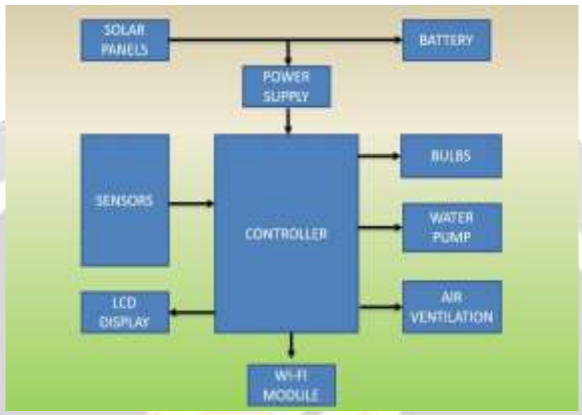

Fig.1 Block Diagram of proposed system.

A. Sensors

As shown in the above Fig.1, a 12 V battery is provided which needs 3 hours charging and gives up to 12 Watt power, this is achieved by solar panels. This power supply is then supplied to the micro-controller NodeMCU. NodeMCU is fed with various sensors like, moisture sensor, LDR, temperature sensor, humidity sensor, gas sensor, fire sensor and raindrop sensor.

Moisture sensor is used to sense the wetness of soil or in other words the moisture present in the soil. When there is no moisture in the soil i.e "0" binary value, then the moisture sensor commands water pump to start. When there is enough moisture in the soil i.e "1" binary value, then there is no need of water in the soil, so the sensor is in normal state. So, indirectly, water pump operation is dependent on moisture sensor.

Fig.2. Moisture Sensor

Light Dependent Resistor (LDR) is used in the project to detect intensity of light and change the resistance accordingly. When there is complete darkness then the LDR light glows i.e the value "1" is generated.

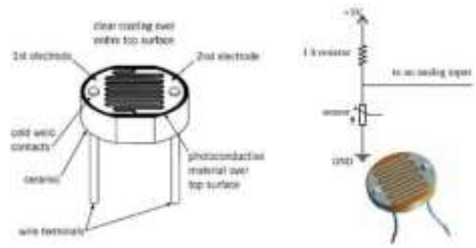

Fig.3. LDR sensor

DHT11 Humidity Sensor has a digital signal output which is ultra-low-cost. It is also a humidity sensor. It measures he changes in Relative Humidity of surrounding according to moisture content.

Fig.4. DHT11 sensor.

LM35 temperature sensor is implemented to sense the temperature. When temperature exceeds the limit (32ºC) a fan is turned on which acts as a coolant. When a desired temperature is attained then the fan turns off automatically due to introduction of relay.

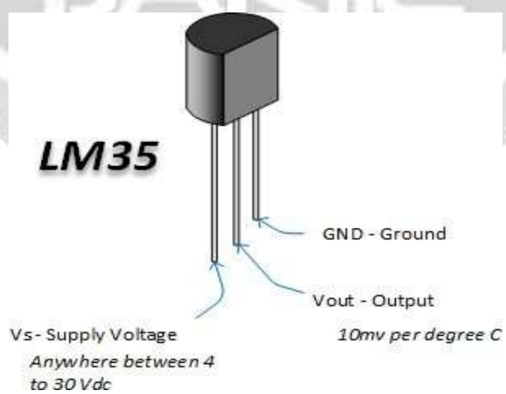

Fig.5. Temperature sensor.

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Raindrop sensor is nickel coated in form of lines which collects the raindrops is shown in Fig.6.. The module is LM393 op-amp based. As rain drops are collected on the circuit board, they create paths of parallel resistance that are measured via the op amp [1]. The sensor is a resistive dipole that shows less resistance when wet and more resistance when dry. When the circuit is dry, high resistance and high voltage is observed and when it is wet low resistance and voltage is observed.

Fig.6. Raindrop sensor.

A Flame sensor depicted in Fig.7 is also embedded in the proposed method. The flame sensor can detect flame and infrared light sources with wavelengths ranging from 760 nm to 1100 nm.

Fig.7. Flame sensor.

In addition to all these sensor, one more sensor is added named as Gas sensor which is shown in the Fig.8. Gas sensor detects the gases. Here we have used MQ-8 gas sensor for detection of hydrogen gas.

Fig.8. MQ-8 Gas sensor.

Moreover, 3 relays are required for water pump, fan and Light sensor as it has automatic switchin on and off configuration. 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.

III. RESULTS AND DISCUSSION

The data read from the DHT11 sensor is sent to the cloud server (Thingspeak.com) and is also displayed on server's IP address as shown in the Fig.9. We can also see the output of LM35 and Moisture sensor.

Fig.10. Data on mobile application.

Fig.11. Temperature and Humidity results.

REFERENCES

[1] https://create.arduino.cc/projecthub/babariyasmit/rain-drop-sensing- system-ce871d

[2] Rangan K. and T. Vigneswaran, "An Embedded systems approach to monitor greenhouse", IEEE Conference on Recent Advances in Space Technology Services and Climate Change (RSTSCC), 2010, pp. 61-65.

[3] Prakash. H. Patil, Chaitali Borse, Snehal Gaikwad and Shilpa Patil, "Greenhouse Monitoring System Using GSM", International Journal of Scientific & Engineering Research, 2013, Vol. 4, Issue 6.

[4] ESP8266 Overview. Available: www.espressif.com

[5] G. Sandhi, F. Buemi, M. Massa, M. Zucchini, "visually guided operations in green-houses", lEEE International Workshop on Intelligent Robots and Systems, 1990