GREENHOUSE MONITORING AND CONTROL SYSTEM USING IOT

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ABSTRACT

This work is primarily about the improvement of current agricultural practices by using modern technologies for better yield. This work provides a model of a smart greenhouse, which helps the farmers to carry out the work in a farm automatically without the use of much manual inspection. Greenhouse, being a closed structure protects the plants from extreme weather conditions namely: wind, hailstorm, ultraviolet radiations, and insect and pest attacks. Greenhouses help to protect crops from many diseases, particularly those that are soil born and splash onto plants in the rain. Numerous farmers fail to get good profits from the greenhouse crops for the reason that they can't manage two essential factors, which determines plant growth as well as productivity. Green house temperature should not go below a certain degree, High humidity can result to crop transpiration, condensation of water vapor, and water evaporation from the humid soil. To overcome such challenges, this greenhouse monitoring and control system comes to rescue. This project demonstrates the design and implementation of a various sensors for greenhouse environment monitoring and controlling.

Keyword :- *Greenhouse, IOT, DHT11, Soil moisture, Microcontroller, Agriculture, Temperature, Humidity*

1. INTRODUCTION

The Agriculture is the backbone of India's economic activity. More than 50% of India's population relies on agriculture and it contributes about 14% to the overall GDP. A Greenhouse can be defined as a close structure which is used to protect the plants from external factors such as climatic conditions, pollution, etc. The crop agriculture in greenhouse is highly affected by the surrounding conditions. Basic factors affecting plant growth are sunlight, water content in soil, temperature, humidity etc. In IOT - based smart greenhouse farming, a system is built for monitoring the crop field with the help of sensors (light, humidity, temperature, soil moisture, etc.) and automating the irrigation system.

(A) Temperature Control: Temperature influences most plant development process including photosynthesis, transpiration, absorption, respiration and flowering. In general, growth is promoted when the temperature rises and inhibited when temperature falls. Each species of plant has a different temperature range in which they can grow. Below this range, processes necessary for life stops, ice forms within the tissue, tying up water necessary for life processes. Above this range, enzymes become inactive and again process essential for life stops.

(B) Humidity Control: Humidity is important to plants because it partly controls the moisture loss from the plant. The leaves of plants have tiny pores, CO2 enters the plants through these pores, and oxygen and water leave through them. Transpiration rates decrease proportionally to the amount of humidity in the air. This is because water diffuses from areas of higher concentration to areas of lower concentration.

(C) Moisture Control: Plants take water from the root system and lose water through transpiring leaves. Large amount of water is lost through transpiration process. The rate of water lost depends on the condition of soil, air flow, relative humidity in air and the temperature of the environment. Hence soil moisture level is needed to be considered.

(D) Light Control: Light plays most important role in photosynthesis process as all living organism get energy from light. The rate of photosynthesis process is reduced in absence of light. Hence there is need to control light in proper proportion for development of plant growth.

2. LITERATURE SURVEY

[1] **Smart Design of Microcontroller Based Monitoring System for Agriculture –**
They have used microcontroller based monitoring system which was developed and which monitors different environmental parameters like soil moisture, relative humidity and atmospheric temperature. Values of those parameter were transmitted wirelessly using radio frequency wireless module to central unit via microcontroller. Different experiments were performed by them to examine sensors as well as wireless module. It was found that there was little variation in moisture sensor's reading when it was exposed to different temperature. Wireless module worked effectively when introduce to various obstacles. Actual implementation of their system on large scale was challenging task for them.

[2] **Micro Controller Based Automatic Plant Irrigation System –**
They proposed an automatic irrigation system which helps in saving money and water. The entire system is controlled using 8051 microcontroller which is programmed as giving the interrupt signal to the sprinkler. Temperature sensor and humidity sensor are connected to internal ports of micro controller via comparator, Whenever there is a change in temperature and humidity of the surroundings these sensors senses the change in temperature and humidity and gives an interrupt signal to the micro-controller and thus the sprinkler is activated.

[3] **A wireless sensors network for monitoring environmental variabe in a tomato greenhouse –**
They proposed a research work in a tomato greenhouse in the South of Italy. They are using sensor devices for the air temperature, pH of water and CO2 level measurements with wireless sensor network. They have also developed a Web-based plant monitoring application. Greenhouse grower can read the measurements over the Internet, and an alarm will be sent to his mobile phone by SMS or GPRS if some measurement variable changes rapidly.

3. METHODOLOGY

Hardware used: Microprocessor- ESP32, LCD- 20*4, 2-channel 5V Relay module, 1-channel 12V relay module, Voltage regulator- 7805, Heat sink, Temperature and Humidity sensor- DHT11, LDR module, Soil moisture sensor, Bulb, Fan, Water-pump, Jumper wires.
Software used: Arduino IDE, Blynk IoT Application
System Architecture:
The proposed system consists of the sensing part, controlling part, monitoring part and a message sending and receiving part. In the monitoring part the sensors included are temperature sensor, humidity sensor, soil moisture sensor and Light detection sensor. These sensors will sense the various parameters of the environment. And the values will be displayed on an LCD display. These sensors are connected to the microcontroller ESP32 which is the controlling part. The actuators (Fan, Pump, Bulb) are switched ON based on the instruction passed to the microcontroller. An LCD is employed to show the condition inside the greenhouse. The system works in such a way that when the environmental parameters cross a safety threshold, the sensors detect a change and the microcontroller reads the data from its input ports and performs the suitable action in order to bring the parameter back to its required level. The microprocessor will continuously display climatic conditions on LCD and will send this data over internet and the user using Blynk IoT application will get the climatic report.

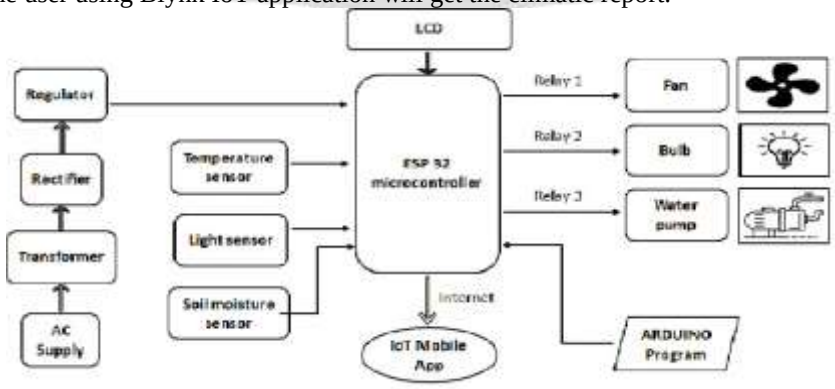

Figure 1: Block Diagram

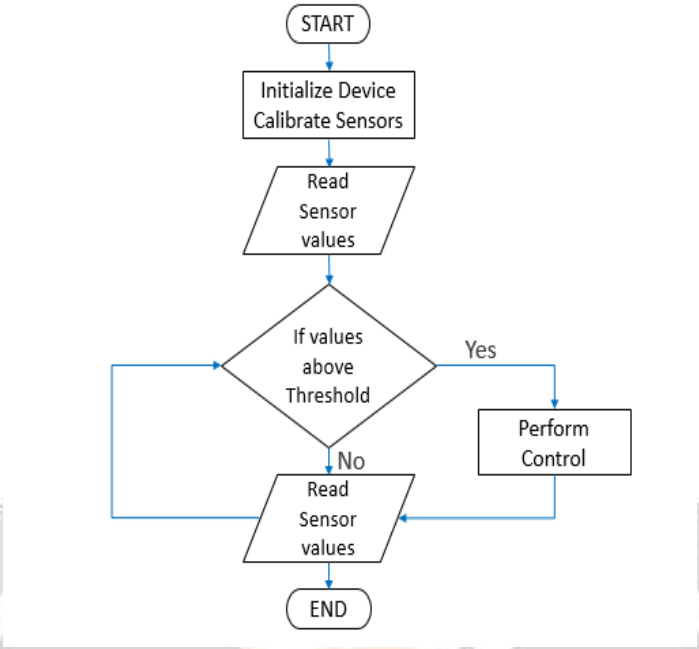

Figure 2: Flow Chart

System Implementation:

For Example, if we take a Tomato crop, the essential parameters are:

a) The user shall set the temperature suitable for a tomato at 27°C

b) The user shall set the value of Humidity suitable for a tomato at 60%

c) The user shall fix the Light intensity at 80%

With respect to the temperature, humidity and light intensity, when the temperature passes the set optimum threshold value, the relay will perform the required action which is to either bring the temperature down when it's too high (27°C) by turning on the cooler and turning the heater on when the temperature is too low. Similarly, when the set value for humidity gets higher than 60%, the heater gets turned on. Also, with the light intensity fixed at 80%, if the value happens to get higher, the light is turned off which results in a reduction of light intensity in order to avoid the production of bad crops.

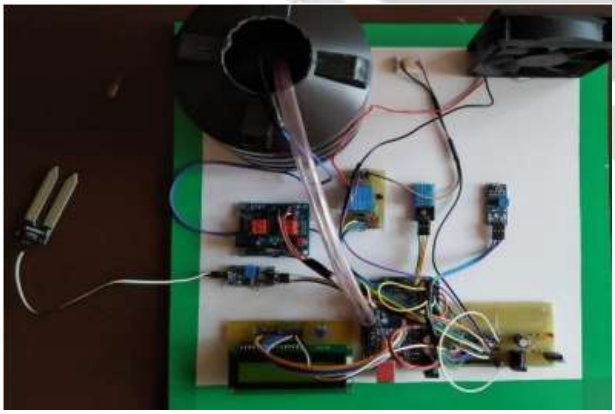

Fig -3: Experimental setup of the proposed work

Fig -4: Implemented prototype of smart greenhouse

Fig -5: Mobile Application screen showing status of the Greenhouse

4. RESULTS AND DISCUSSION

This control unit collects all the details regarding the plant growth, consisting of moisture, temperature and light sensor with a mini water tank attached for supplying sufficient amount of water to plants. The whole controlling system is having a power supply of 5V. LED is present in the controlling unit for providing enough light for the plants and a mini fan for controlling the temperature. Display console shows the measured values of moisture and temperature. We have created a cloud for storing all the details about the growth of plants. And have developed an android application for monitoring the greenhouse and controlling the environment inside the greenhouse.

5. CONCLUSION

A smart greenhouse monitoring system has been implemented successfully using the concept of IoT which can prove to be a boon for agriculture sector. 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 and thus increase the overall yield. The smart greenhouse automatically optimizes the various parameters for the plant growth. It sends the real time data of parameters to the mobile app for continuous and effective monitoring.

6. REFERENCES

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