Automatic Greenhouse Environment Monitoring and Controlling System

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Abstract: **Agriculture is a most important part of our human life and the condition around the agriculture environment is changes within time. In the greenhouse environment we can change as per the growth of plants. The conditions around the greenhouse have a greater impact on crop agriculture. Temperature, humidity, lighting intensity, the moisture content of the soil, various gases present in the greenhouse environment and the amount of CO2 in the greenhouse are the most important environmental factors that influence the quality and productivity of the plant growth. A lot of research has been carried out in order to be able to develop a monitoring and controlling of greenhouse environment that will help in solving the main problems relating to agriculture which is to enable the increase in the productivity of crops. Green house farming is the unique farm practice of growing crops within a controlled environment weather and climate condition controlling is the prime concept of greenhouse. The main aim of this project is to design a simple, low cost, Arduino based system to monitor the values of environmental parameters and that are controlled in order to achieve optimum plant growth and yield. DHT11 sensor, Soil Moisture sensor, humidity sensor, gas sensor are the main sensors used in this project which give the exact value of temperature, humidity, water content, light intensity respectively. By using Arduino if the preset value of any parameter is exceed low or high then they can control actuators (exhaust fan, water pump, heating light, buzzer and motor pump) and all this parameters values and condition of the actuators are display on the LCD display. That will help to growth of the plant, The result obtained was a fully functioning system that was set to monitor the greenhouse environment.**

Keywords: **Greenhouse, Monitoring, Controlling, Arduino, Sensors.**

1. Introduction

In most of the countries this system is mostly follow for good growth of the plants. In day by days most of the things can be monitored and controlled automatically. The most important sector like agriculture, the various work is done by manually. The greenhouse monitoring and controlling is mostly affect on the productivity of agriculture. In this project the greenhouse parameters like humidity, temperature, light intensity, soil moisture and various gases present in the greenhouse we can monitor and control by using Arduino. Arduino can receive input from various sensors and it can control water pump, heating bulb, gas buzzer and exhaust fan. Four sensors, DHT11 sensor, Soil moisture sensor, humidity sensor and gases sensor are used. DHT11 sensor is used to measure temperature and humidity. Soil moisture sensor measures the water content in soil. Gas sensor are used to detect the various gas present in the greenhouse environment. If the humidity sensor will be sensing the humidity in greenhouse is greater than 50% then the Arduino send signal to exhaust fan through relay to turning ON otherwise it will OFF. If soil moisture sensor detect soil is DRY then Arduino send signal to water pump through relay to turning ON otherwise it will OFF. If gas sensor detects the gas present in the greenhouse, then Arduino send signal to buzzer and exhaust fan through relay to turning ON otherwise it will OFF. If the temperature sensor senses the temperature in greenhouse is less than 25°C then the Arduino send signal to heating bulb through relay to turning ON otherwise it will OFF. All greenhouse environment parameters will be control by the Arduino.

2. Literature Survey

In this we have discuss about various research taken in the area of agriculture sector and greenhouse related information to we used to build our project. Related literatures are presented as follows.

Vimal et al., in [1] The work in this paper focusing on development of greenhouse monitoring and controlling system by using Arduino, Sensors, GSM, Ethernet. For a development of the crops growth. For easy of the farmer development of the Arduino, Sensors, GSM, Ethernet based technology.

Aiswariya et al., in [2] The purpose of this research is to monitor and control the parameters inside the greenhouse. The temperature, humidity, soil moisture, and fertilizer are the important parameters that determine the quality of the plant yield. Thus, the controlling and monitoring of all the above mentioned parameters inside the greenhouse using wireless sensor networks with low cost and optimum power consumption and to track the changes anywhere in the world using IoT is the main objective of the proposed system.

Zhang et al., in [3] This paper is focusing on with the rapid development of wireless technologies, it is possible for Chinese greenhouses to be equipped with wireless sensor networks due to their low-cost, simplicity and mobility. In the current study, we compared the advantages of ZigBee with other two similar

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wireless networking protocols, Wi-Fi and Bluetooth, and proposed a wireless solution for greenhouse monitoring and control system based on ZigBee technology. As an explorative application of ZigBee technology in Chinese greenhouse, it may promote Chinese protected agriculture.

Gaikwad et al., in [4] This paper design and implementation of smart greenhouse monitoring system using ZigBee technology. This system is made up of front-end data acquisition, data processing. The processed data is sent to the intermediate node through a wireless network. PC provides a real time data for greenhouse fans another temperature control equipment and achieve automatic temperature control. This paper focusing on by using Internet of Things, ZigBee, Greenhouse, Microcontroller can be monitoring and controlling of greenhouse parameters.

Girija et al., in [5] The system proposed in this paper is an advanced solution for monitoring the weather conditions at a particular place and make the information visible anywhere in the world. By using Internet of Things (IoT) Embedded Computing System; Arduino Software, ESP8266, Smart Environment can be made the system smart. Environmental parameters can be control and monitor from anywhere locate of farmer.

3. System Overview

In this project consisting of two sections, monitoring section and controlling section. The monitoring section consists of DHT11 sensor, Gas sensor, Soil moisture sensor and alcohol sensor to monitor the environmental parameters. The controlling section consists of exhaust fan, water pump, heating bulb and Buzzer By using Arduino controlling section can be control. Arduino microcontroller forms the heart of the system. The block diagram of greenhouse monitoring and controlling system is shown in fig. 1.
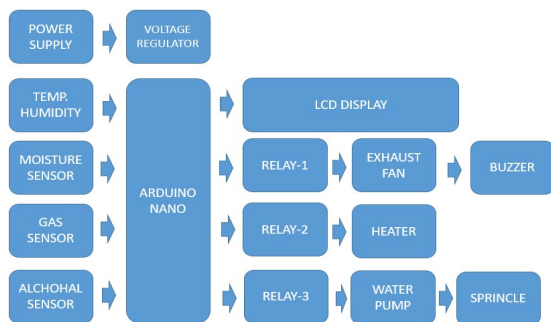

Fig. 1. Block diagram of greenhouse monitoring and controlling system

A. Arduino

Arduino Nano is one type of microcontroller board, and it is designed by Arduino.cc. It can be built with a microcontroller like Atmega328. This microcontroller is also used in Arduino UNO. It is a small size board and also flexible with a wide variety of applications. It doesn't have any DC jack so that the power supply can be given using a small USB port otherwise straightly connected to the pins like VCC & GND. This board can be supplied with 6 to 20volts using a mini-USB port on the board. Operating voltage is 5v and it have 14 digital I/O and 8 analog input pins.

Fig. 2. Arduino

B. Sensors

Used sensors are DHT11 sensor, Gas sensor, Soil moisture sensor and alcohol sensor are used.

1) DHT11 Sensor

DHT11 sensor is used to measure both temperature and humidity. It is a low-cost temperature and humidity sensor. It has a thermistor for measuring the temperature and a humidity measuring component for measuring humidity. Operating Voltage: 3.5V to 5.5V, Temperature Range: 0°C to 50°C, Humidity Range: 20% to 90%.
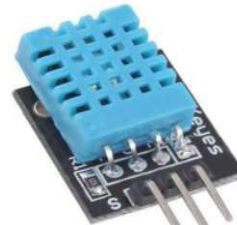

Fig. 3. DHT11 Sensor

2) Soil moisture sensor

Soil moisture sensor used to measure the moisture content in the soil by using two metal rods, this sensor is buried in the ground and two rods are short, if water content is more in soil, then the soil resistance is low and water content in the soil is less then soil resistance is high. This is an easy-to-use digital soil moisture sensor. Just insert the sensor in the soil and it can measure moisture or water level content in it. It gives a digital output of 5V when moisture level is high and 0V when the moisture level is low in the soil.

Fig. 4. Soil moisture sensor

3) MQ2 gas sensor

This is a robust Gas sensor suitable for sensing LPG, Smoke, Alcohol, Propane, Hydrogen, Methane and Carbon Monoxide concentrations in the air. If you are planning on creating an indoor air quality monitoring system; breath checker or early fire detection system, MQ2 Gas Sensor Module is a great choice.

Table 1
Four conditions for monitoring and controlling of the greenhouse

Sr.No.	Actuator Sensors	Condition	Action Taken
1.	Humidity Sensor	1. H > 50%	1. If the greenhouse humidity is greater than 70% then the system taken action by turning ON exhaust fan.
		2. H < 50%	2. If the greenhouse humidity is less than 70% then the system taken action by turning OFF exhaust fan.
2.	Temperature Sensor	1. T > 25°C	1. If the greenhouse temperature is greater than 24°c. then the system taken action by turning OFF heating bulb.
		2. T < 25°C	2. If the greenhouse temperature is less than 24°C. Then the system taken action by turning ON heating bulb.
3.	Soil Moisture Sensor	1. Soil - WET	1. If the soil moisture is WET which will be indicating on LCD Display, then the water pump is OFF.t
		2. Soil -DRY	2. If the soil moisture is DRY which will be indicating on LCD Display, then the water pump is ON.
4.	Gas Sensor and Alcohol Sensor	1. Gas-N Alcohol-N 2. Gas-D Alcohol-D	1. If gas is not detected in the greenhouse which is harmful to the crops, then the exhaust fan is turn Off. 2. If gases are detected in the greenhouse which is display on the lcd display, then the exhaust fan is turn Off.

Fig. 5. MQ2 gas sensor

C. DC Diaphragm Based Mini Aquarium Water Pump

This pump can be used provide water supply to the plant. R385 6-12V DC Diaphragm Based Mini Aquarium Water Pump is an ideal non submersible pump for variety of liquid movement application. It has enough pressure to be used with nozzle to make spray system. This is 7w pump and work on the voltage up to 6v to 12v DC supply.

Fig. 6. Water pump

D. Liquid Crystal Display (LCD 24*4)

A 20x4 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. A 20x4 LCD means it can display 20 characters per line and there are 4 such lines. In this LCD each character is displayed in 5x7 pixel matrix. It has 4 or 8 bit data I/O interface.
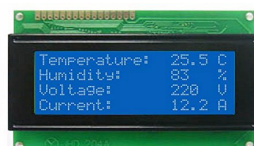

Fig. 7. LCD

4. Results and Discussion

All the components are supply by power supply of +5V. Sensors used are, DHT11 sensor, gas sensor, Soil moisture sensor and Alcohol sensor are used, all these sensors send the sense value to the Arduino which these all sensors are connected to the Arduino. A buzzer, exhaust fan, water pump, heating bulb and motor pump are also connected to the Arduino. And LCD display are also connected to the Arduino. For working of the project there are four conditions for monitoring and controlling of the greenhouse shown table 1.
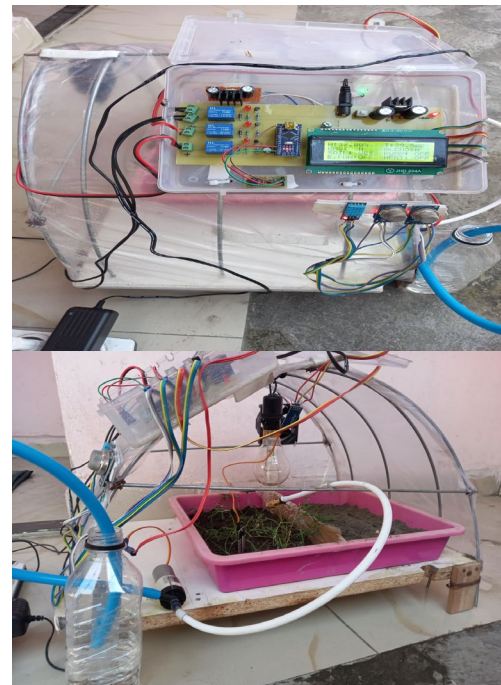

Fig. 8. Hardware setup

5. Conclusion

An Arduino based greenhouse monitoring and controlling system is designed. DHT11 sensor, Soil Moisture sensor, Gas sensor and alcohol sensor are the main sensors used in this project which give the exact value of temperature, humidity, moisture content, light intensity and soil pH respectively. The

greenhouse's temperature, humidity, moisture, alcohol and gas level could all be tracked by the greenhouse's monitoring and control system. Based on the various changes in the environment, the various sensors were able to initiate an actuator. This research paper is to focusing on convenience and ease of crop growth for farmers. This system will enable farmers to plant healthy crops with the supervision of smart technology.

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