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ABSTRACT

This project named greenhouse automation senses the soil moisture content, temperature and light intensity within a greenhouse and controls the same based on the sensed values. The system uses a couple of sensors, control devices and an arduino UNO to perform its tasks. The status of the above mentioned parameters as well as their control devices are displayed on an LCD display. Thus, this system brings about efficient data acquisition and control of the microclimatic parameters within the greenhouse. It also significantly reduces the labour involved in its maintenance thus making the system useful for rural farmers, small scale agriculturists, gardeners, and agricultural researchers.

INTRODUCTION

The world climate change has brought about unpredictable weather conditions that have resulted in the global food shortage being experienced. A possible solution to this problem will likely involve households growing a reasonable percentage of the vegetables and crops they need in a greenhouse which does not require too much land space. A greenhouse can produce more crops per square meter when compared to open field cultivation if the microclimatic parameters that determine crop yield are continuously monitored and controlled to ensure that an optimum environment is created.

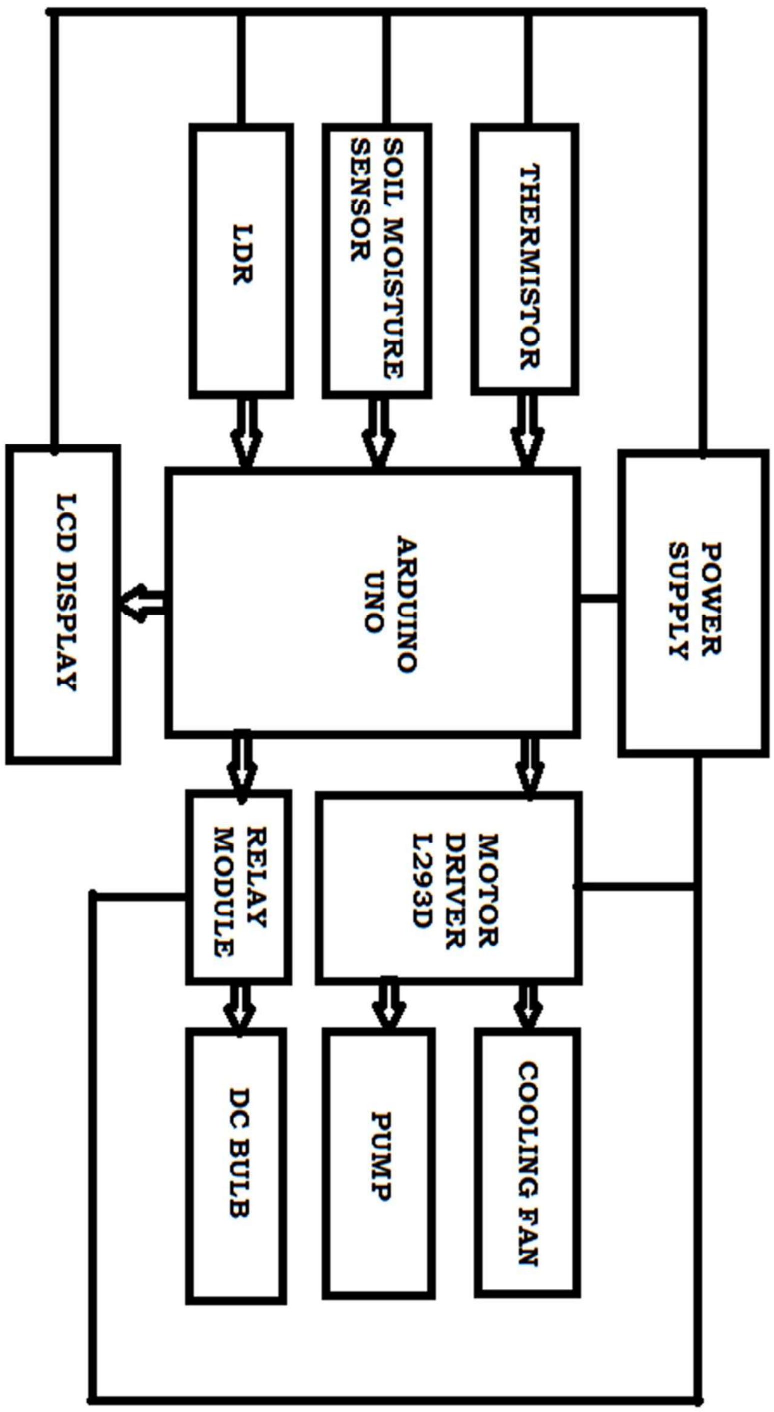
Currently greenhouses are monitored and controlled either manually by going on the field or by monitoring and controlling the sensor network remotely. In this system control decisions are taken by the system itself based on the sensed values without human interference.

The automated greenhouse control system achieves monitoring and control of a greenhouse environment by using sensors and control devices which are under the control of a microcontroller running a program. Only three parameters namely soil moisture, temperature and light are taken into consideration for the design of this project. But more parameters can be added if necessary. Accordingly, a soil moisture sensor and a water pump, a thermistor and a cooling fan and an LDR and few DC bulbs are used to sense and control the soil moisture content, temperature and light intensity respectively. The output of the sensors and the status of the control devices are displayed on an LCD display.

OBJECTIVES OF THE PROJECT

1. To measure the temperature, light intensity and soil moisture content within a greenhouse.
2. To display the sensors readings in real time to the user on an LCD display.
3. To act upon sensor readings that deviate from the defined range using the pump, cooling fan and DC bulb.
4. To display the status of these control devices to the user on an LCD display.

CIRCUIT COMPONENTS



BLOCK DIAGRAM

Sl. No.	COMPONENTS	COST (Rs.)
1	ARDUINO UNO	700
2	SOIL MOISTURE SENSOR	200
3	LDR	8
4	THERMISTOR NTC 10K	12
5	RESISTORS 10K, 100K (2 NOS)	6
6	MOTOR DRIVER L293D	200
7	MINIATURE WATER PUMP 12V	200
8	MINI MOTOR 12V	20
9	RELAY MODULE 5V	84
10	DC BULBS 4V (6 NOS)	60
11	LCD DISPLAY 16X2	200
12	12 V DC ADAPTER	200
13	POTENTIOMETER 10K	20
14	OTHER	300
	TOTAL	2210

TABLE OF COMPONENTS

COMPONENT DESCRIPTION

1. ARDUINO UNO

The Arduino UNO is an open-source microcontroller board based on the ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (of which 6 can be used as PWM outputs), 6 analog input pins, a 16 MHz quartz crystal oscillator and is programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable. The six analog inputs provide 10 bits of resolution (i.e., 1024 different values). It has a flash memory of 32 kB, of which 0.5 kB is used by the boot loader. It has an SRAM of 2 kB and an EEPROM of 1 kB. It can be powered by a USB cable or by an external supply from 7 to 12 V, using an AC to DC adapter or a battery. It has a 5V pin and a 3.3V pin to supply power to external devices. Both can supply a maximum of 50mA. Each input or output pin operates at 5V and can provide or receive 20mA.

2. SOIL MOISTURE SENSOR

Soil moisture sensors measure the volumetric water content in the soil indirectly by using some property of the soil, such as electrical resistance, dielectric constant, etc. The relation between the measured property and soil moisture must be calibrated and may vary depending on environmental factors such as soil type, temperature, or electric conductivity.

3. LIGHT DEPENDENT RESISTOR (LDR)

An LDR is a light-controlled variable resistor. The resistance of an LDR decreases with increasing incident light intensity. It is made of a high resistance semiconductor. In the dark, it can have a resistance as high as several mega ohms (MΩ), while in the light, it can have a resistance as low as a few hundred ohms.

4. THERMISTOR

A thermistor is a type of resistor whose resistance is dependent on temperature, more so than in standard resistors. Thermistors are of two opposite fundamental types:

- With NTC thermistors, resistance decreases as temperature rises. An NTC is commonly used as a temperature sensor, or in series with a circuit as an inrush current limiter.
- With PTC thermistors, resistance increases as temperature rises. PTC thermistors are commonly installed in series with a circuit, and are used to protect against overcurrent conditions, as resettable fuses.

5. RELAY BOARD

A relay board consists of a relay in conjunction with the circuit needed to interface it with the arduino. A relay is an electrically operated switch. When a high input signal is fed to a relay, it closes its normally open contact and opens its normally closed contact and hence completes the circuit that it is driving.

6. DC BULBS

Six 4 V DC bulbs are used in this project. It is connected as a parallel combination of two series combinations of 3 bulbs each. It is powered from a 12 V supply using the relay board and hence provides artificial lighting to the plants in the greenhouse.

7. MOTOR DRIVER

Motor drivers are boards used to interface dc motors to the arduino. When the arduino sends an ON signal to a particular input port of the motor driver, the motor connected to the corresponding output port gets turned on.

8. MINIATURE WATER PUMP

A 12 V DC submersible miniature water pump is used to pump water to irrigate the soil. It is controlled by the motor driver.

9. MINI MOTOR

A 12 V DC mini motor coupled with fan blades is used to represent the cooling fan inside the greenhouse. It is also controlled by the motor driver.

10. LCD DISPLAY

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in colour or monochrome. A 16 x 2 LCD display is used in this project to display the sensor outputs and the status of the control devices.

11. DC ADAPTER

DC adapters provide a regulated DC output taking input from an AC supply. A 12 V DC adapter is used to power the arduino and thereby the sensors and LCD display, the relay module, thereby the DC bulbs and the motor driver thereby the pump and the mini motor.

WORKING

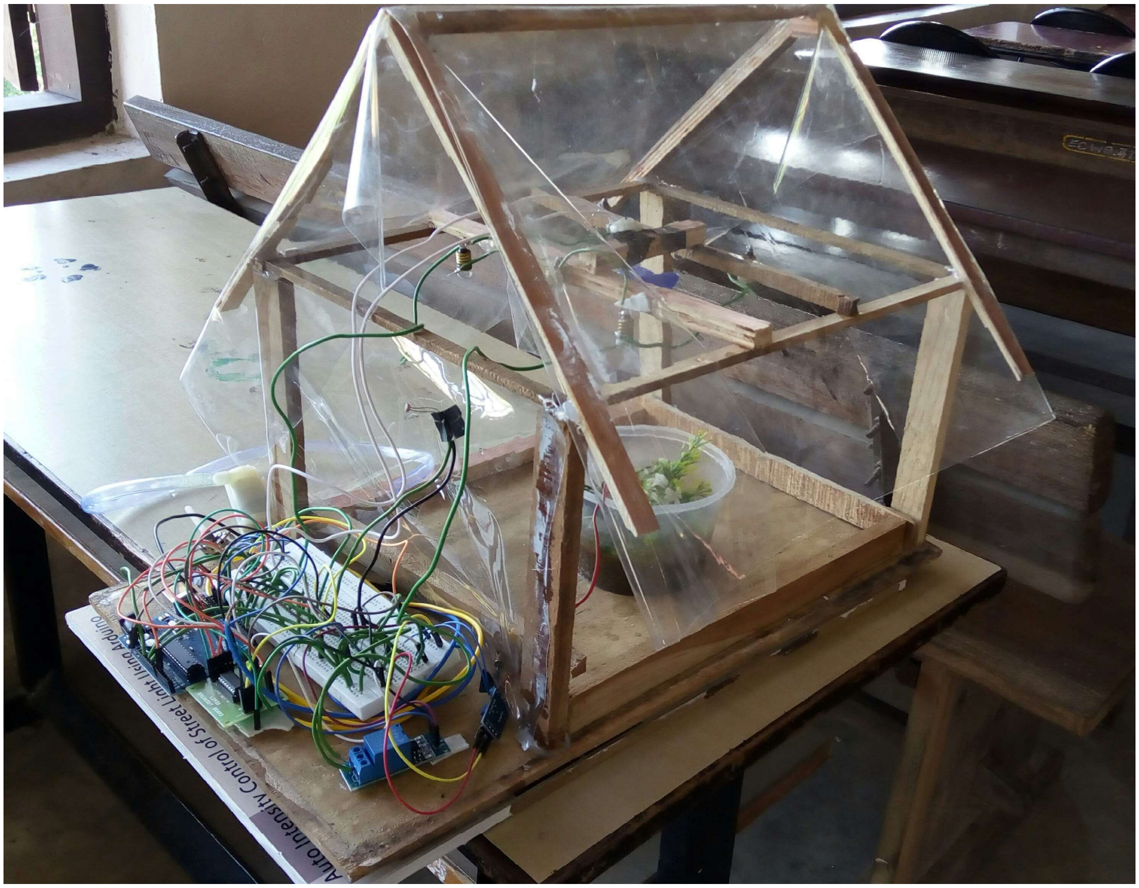
Arduino monitors the sensor outputs continuously. The output of the soil moisture sensor increases as the soil becomes dry. Arduino reads the outputs of the soil moisture sensor, compares it with an upper and lower threshold values and determines whether the soil moisture is high (H), medium (M) or low (L). The output of light sensing circuit increases with increase in light intensity. Arduino reads this output, compares it with an upper and lower threshold values and determines whether it is high (H), medium (M) or low (L). The output of the temperature sensing circuit decreases with increase in temperature. Arduino reads and using Steinhard equation, converts it into the corresponding temperature. Then the status of soil moisture content, light intensity and value of temperature are displayed in the LCD display.

If the soil moisture is low i.e., if the output of the sensor is above an upper threshold value, a pump is turned on so that it irrigates the soil. Thus the soil moisture content increases, the output of the sensor decreases and when it falls below a lower threshold value, the pump is turned off.

If the temperature goes above a threshold value, a fan is turned on so as to cool the interior of the greenhouse. When the temperature falls below this value, the fan is turned off.

If the light intensity goes below a threshold value, DC bulbs are turned on and when the light intensity becomes normal, the bulbs are turned off.

The status of the pump, cooling fan and the bulbs are then displayed on an LCD display.



WORKING MODEL

PROGRAM

```
#define ONE_WIRE_BUS 8 //temp sensor
float sensorValue=0;
int LDRValue = 0 ;// result of reading the analog pin
int RelayPin =9 ;//relay pin
int sensorPin=A0;//moisture sensor
float temp = 0.0; // variable to store the measured temperaturevariabele (float = floating
point number)
int oneWireBus = 12;
OneWire oneWire(oneWireBus); // 1-wire instance on the oneWireBus pin
DallasTemperature sensors(&oneWire); // give the OneWire instance as parameter to the
DallasTemperature library
const int ledPin = 12;//LED light
const int ldrPin = A1;//LDR value read from this pin
void setup() {
pinMode(RelayPin, OUTPUT);
pinMode(ledPin, OUTPUT);
pinMode(ldrPin, INPUT);Serial.begin(9600);
sensors.begin();
}
void loop() {
sensors.requestTemperatures ( ) ; // Sending the commands to get the temperature values from sensor
Serial.print("Temperature: ");
Serial.print(sensors.getTempCByIndex(0));
Serial.print((char)176);//shows degrees character
Serial.print("C | ");
//print the temperature in Fahrenheit
Serial.print((sensors.getTempCByIndex(0) * 9.0) / 5.0 + 32.0);
Serial.print((char)176);//shows degrees character
Serial.println("F");
sensorValue=analogRead(sensorPin);//moisture sensor
if (sensorValue>550){
digitalWrite(RelayPin, HIGH);delay(3000);
digitalWrite(RelayPin,LOW);
delay(3000);
}
int ldrStatus = analogRead(ldrPin);
if (ldrStatus <=300) {
digitalWrite(ledPin, HIGH);
Serial.println("LDR is DARK, LED is ON");
}
else {
digitalWrite(ledPin, LOW);
Serial.println("LDR is Not DARK, LED is OFF");
}
delay(5000);}
```

APPLICATIONS

Green house automation systems can be used in places where

1. Climate doesn’t support growth of plants

2. Superior care of crops is needed

3. High productivity is required

4. Minimum man power is available

5. Insect attack is more

FUTURE SCOPE

Automated greenhouse monitoring system can be improved in many ways and can be used in wide applications. Non-conventional energy source such as solar panels, wind mills, etc. can be used to supply power to the automated greenhouse monitoring system equipments. It can also be improved in such a way that the status of the sensors and control devices gets stored in a database can be viewed by the user using a website. Additionally, sensors to measure the nutrient levels in the soil can be used to sense and control same in the same way soil moisture is controlled. It has a bright future in agriculture field and it will create a revolution on it.

CONCLUSION

Greenhouses protect plants from the effects of climate; insects and so on. The automation and high efficiency of greenhouse environment monitoring and control are crucial. Our system enables people to monitor and manage growing conditions of their greenhouse. The use of sensor nodes help people grow plants more efficiently. Implementation of such a system in the field can definitely help to improve the yield of crops and overall production, and with its quality to cost ratio, it will be affordable to the majority of the agricultural community and also to the agro-based industries.

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