GREENHOUSE MONITORNG AND CONTROLLLING SYSTEM BY ARDUINO

MINI PROJECT REPORT

Project by	Under the Guidance
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ABSTARCT

Today agriculture is changing in response to the requirements of modern society, where ensuring food supply through practices such as water conservation, reduction of agrochemicals and the required planted surface, which guarantees high quality crops are in demand. Greenhouses have proven to be a reliable solution to achieve these goals; however, a greenhouse as a means for protected agriculture has the potential to lead to serious problems. The most of these are related to the inside greenhouse climate conditions where controlling the temperature and relative humidity (RH) are the main objectives of engineering. Achieving appropriate climate conditions to ensure high yield and quality crops reducing energy consumption have been the objective of investigations for some time.

Our system is used to control the climate inside the greenhouse. Indeed Greenhouses are considered as too difficult to maintain as the temperature needs continues monitoring. As of today famers are forced to appoint labour for monitoring the climate. This system would help farmers to control the climates of greenhouse effortlessly by using various controlling units as they get instructions from Arduino. Arduino is the heart of the system which is coded according to the climate measures we want. Therefore, when the conditions fail Arduino would generate the signals for maintaining those variations and fix them as fast as they can. This system will be more functional and responsive instead of affording the labour. Here we have the hardware control units which are exactly appropriate for the corresponding climate variations. So the response from the Arduino will be executed successfully by the fans and motors. The changes like Temperature, Humidity, Light, and Soil will be recovered by the controlling units such as fans, lights, water pump. Arduino works as a heart which can pump every units that has connected to it. Every single changes captured by the sensors will be responded by Arduino as soon as possible. Greenhouses are considered as sensitive in climate fluctuations which can cause the plants affected, So that the farmers are being eager to correct even the small changes.

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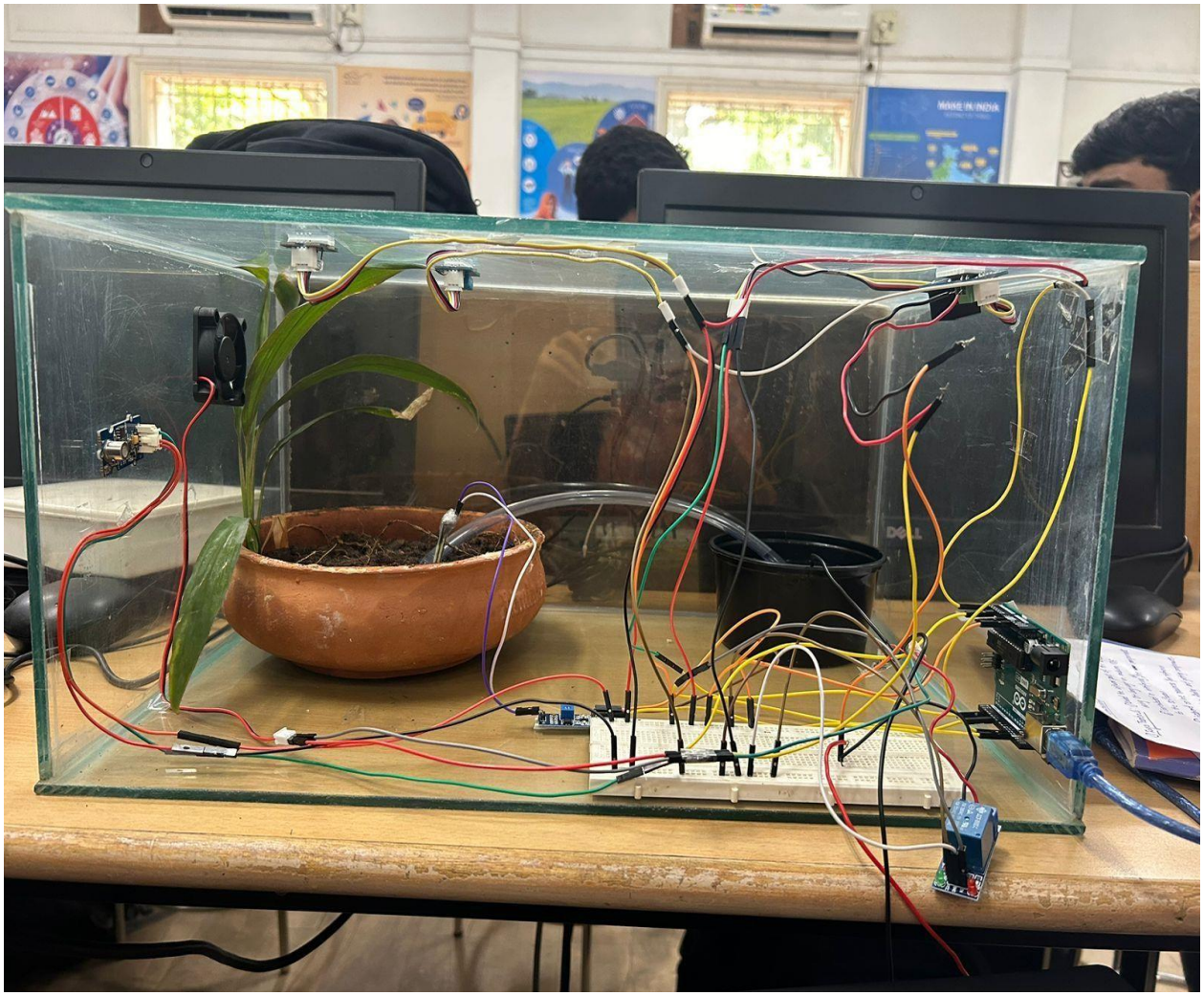

MADE IN INDIA

INTRODUCTION

India is a country where the economy is dependent on agricultural produce. There is continuous increase in demand for food production technology. India weather conditions are characterized by having predominantly long and hot summers and short and mild winters. Such climatic conditions put a great strain on the types of crops that could be successfully grown. This is very much true with most horticultural vegetables with medium thermal requirements (tomato, pepper, cucumber, watermelon, marrow, green bean, eggplant).

Agricultural means can satisfy the food production demand. But due to isotropic climatic conditions. This ultimately affects the plant growth. Also there are many such problems associated with it. To overcome from this problem. Pests and diseases, and extremes of heat, humidity, light and temperature, and irrigation is necessary to provide water. The farmers have been using different irrigation technique for increasing production. These techniques were done by human intervention. But due to this sometimes either the plants consume more water or the water reaches late up to the plants.

Greenhouses protect crops from too much heat or cold, shield plants from dust storms and help to keep out pests. Light and temperature control allows greenhouses to become suitable place for growing plants. The cultivation exhibition of plants under controlled conditions. Greenhouses also are often used for growing flowers, vegetables and fruits.

In other word, a greenhouse is a structure that provides protection and a controlled environment for raising plan indoors. The primary issue of greenhouse based horticulture is to manage the greenhouse environment optimally in order to comply with the economic and environmental requirements.

We can use an automatic or manual micro-controller (Arduino) based system. For automatic monitor and control for greenhouse we are developing an embedded system which will record the temperature, moisture and other parameters that will control the environmental conditions in the plant field. Moreover for effective control, an interface application is used along with embedded system

PROPOSED SYSTEM

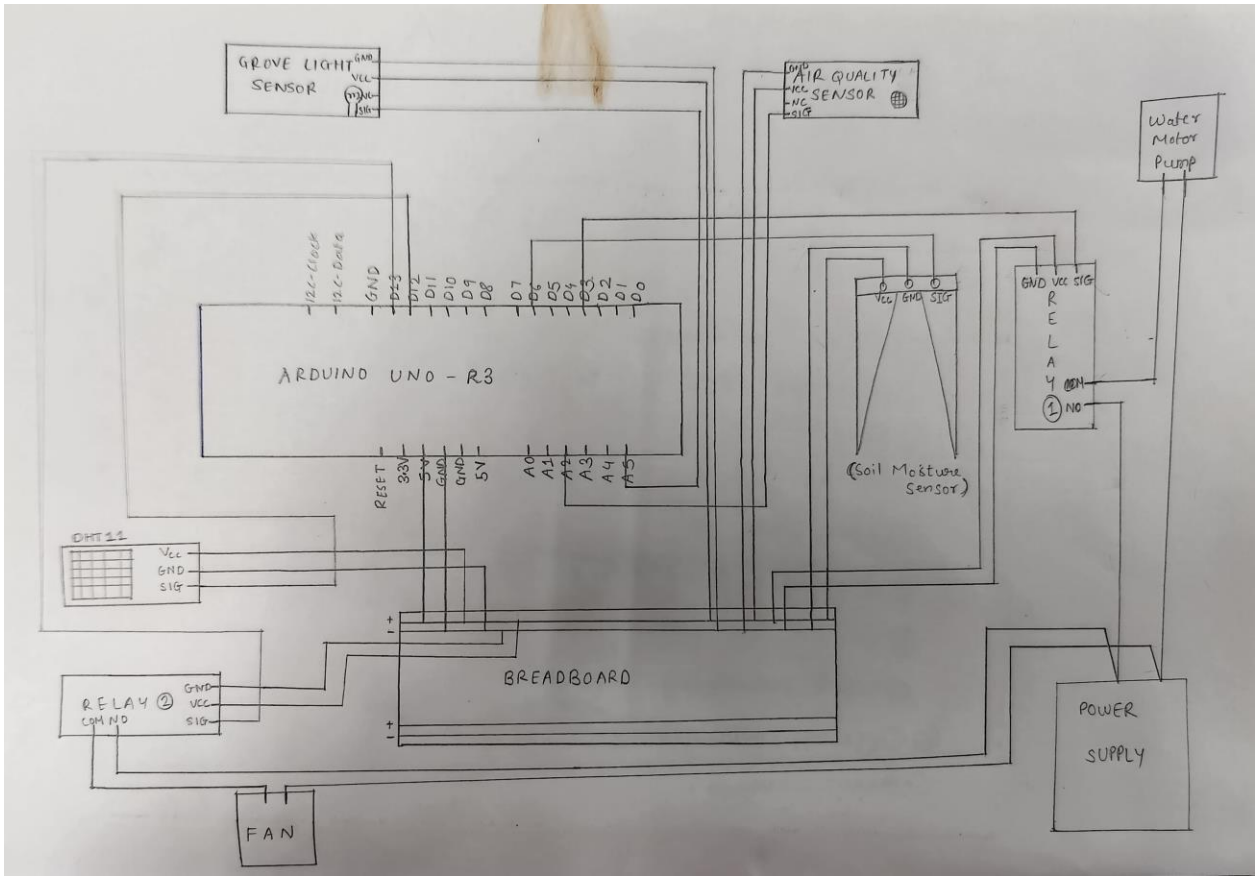
Automatic climate control facility to the system as it should control the climate by getting the signals from Arduino. Arduino is a micro-controller which is programmed to control the entire system. Here we have various registers which are used to detect the parameters such as Temperature, Humidity, Soil Moisture and Light intensity. Arduino works such a way that it receives signals from sensors and generate the appropriate signals on the basis of the code which is given. Generated signals would enable the relays that are used as a switch to turn on\off the control systems (Fan, Motor,Water pump) which would work till the required parameters are being met. The entire system works in 5V, 12V DC supply given by sources such as Batteries, Powerbanks etc. As software works the hardware will be perform their appropiate operations in a given manner. Arduino output would be passed to the Hardware units which perform the action in a way that to control the entire climate conditions.

Advantage of Proposed System

- Reduce cost of production.
- Improved plant growth, yield and quality.
- Accurate control of greenhouse climate systems.
- Low power consumption.

CIRCUIT DESIGN

5.1 Circuit Design

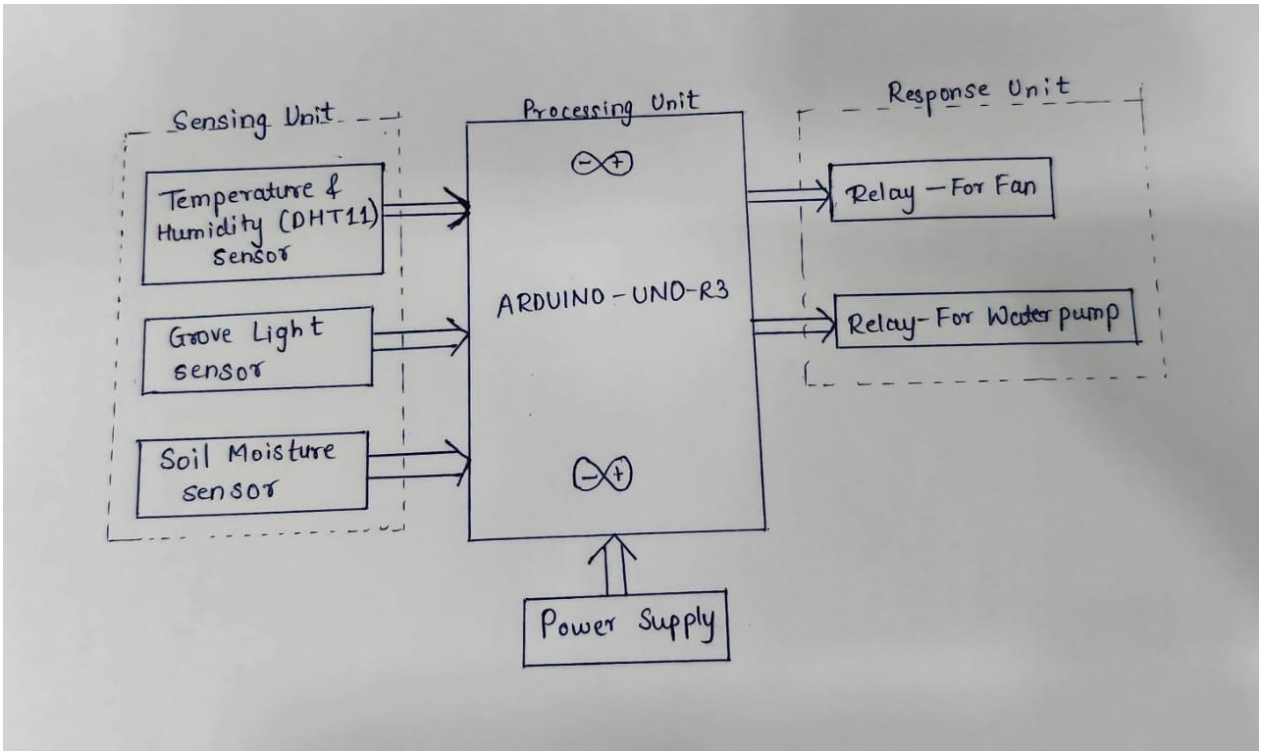


In this system Arduino is the heart of whole system which takes control over the process. When sensors sense any change in environment or in soil Arduino comes in action and process the required operation. When soil moisture sensor does not sense moisture in soil then Arduino turns on the water pump and sends a message to the owner of status that the motor is turned on. And if dht11 sensor senses the temperature less than the optimum temperature given in the code , then Arduino turns on the fan and sends a message to the owner of status that the fan is turned on .

Grove light sensor is used for sensing light intensity

An Overview of the Greenhouse Design

The proposed greenhouse system is shown below , as can be grasped, the system has the following units: sensing unit, processing unit, displaying unit, communication unit, and actuators unit. In the following, the units of the proposed greenhouse system were designed, simulated, implemented, tuned and integrate.



5.2 Sensing Unit

Sensor is a device for sensing a physical variable of a physical system or an environment. It senses the environmental phenomena and output an electrical signal. An actuator may be described as opposite to a sensor it converts electrical signal into generally nonelectrical

energy. For example, an electric motor is an actuator it converts electric energy into mechanical action.

The following factors must be considered when choosing sensor :

- Rang and span: This represent the range a limits heater which the input can vary. The span is the maximum value of the input minus the minimum value.
- Errors: It is the different between the result of the measurement and the free value of the quantity being measured where (Error = measured value – free value).
- Accuracy: It is the extent to which the value indicated by measurement system might be varying. It is the summation all possible error that to accuracy.
- Sensitivity: It is relationship indicating how much output you get per unit input.
- Stability: It is the ability to give the same output when used to measure a constant input over a period of time.
- Resolution: When input varies continuously over the range the output signals for the some seasons may change in serial steps.

5.2.1 Temperature and humidity sensor

Temperature sensing technology is one of the most widely used sensing technologies in the modern world. It allows for the detection of temperature in various applications and provides protection from excessive temperature excursions. The DHT11 shown in Figure 5.3.1 was selected in this application. DHT11 is a basic, low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed). It's fairly simple to use, but requires careful timing to grab data. The only real down side of this sensor is you can only get new data from it once every 2 seconds.

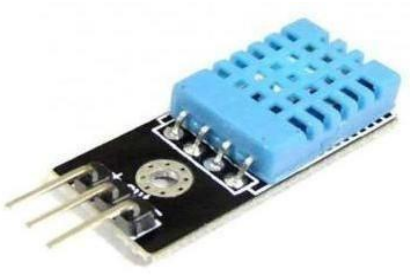
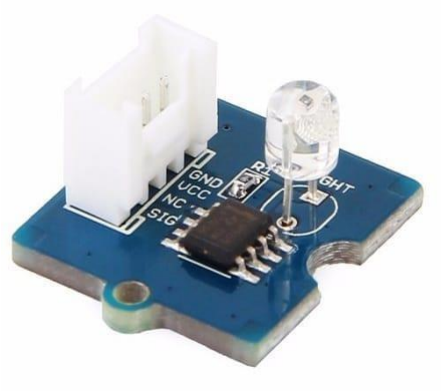


Fig 5.3.1 DHT11 Sensor

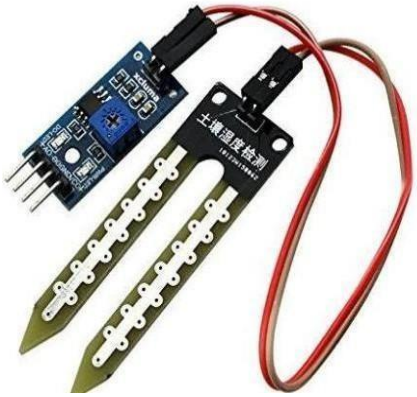
The Grove Light sensor

The Grove Light sensor integrates a photo –resistor (light dependent resistor) to detect the intensity of light. The resistance of photo-resistor decreases when the intensity of light increases. A dual Op Amp chip LM358 on board produces voltage corresponding to intensity of light (i.e. based on resistance value). The output signal is analog value, the brighter the light is, the larger the value.



Soil Moisture Sensor

The Soil Moisture Sensor is used to measure the volumetric water content based on the dielectric constant of soil. The sensor is inserted in the soil to sense the existence of water. An electric current can easily pass through if there is moisture and due to the fact that the level of moisture is hard to determine and to make sure that the moisture sensor is very accurate and efficient.



Processing Unit (Arduino)

Arduino is a situated of advancement sheets that accompany pretested equipment and programming libraries. That is to say, easy to Arduino board and begin adding to your task immediately. The Arduino is open-source electronics prototyping platform environment built for designers and artist's people with little technical expertise.

Fig5.4.1 Arduino UNO

Advantages Of Arduino

- Inexpensive.
- Open source in hardware.
- Don't need to external programmer (Burner)
- Programming ease.
- Open source in software.
- IDE Software operate on any operating system

Actuation Unit

An actuator is a piece of equipment which will produce a movement when signal is given. Actuators are used in the computer control of an environment, industrial automation and in robotics or, more generally, actuators are the machines used for output in control applications. For the situation in a computer controlled greenhouse, the actuators receive their control signal from the Arduino to control the inside climate variables of the greenhouse.

The designed unit includes the following actuators:

I] A ventilation fan: Its speed determines the exchange between inside and outside air, thus causing natural ventilation.

II] DC Fan: It has developed for applications with demanding environmental requirements, signal speed, external temperature sensor, analogue control input, and moisture protection.

III] Water Pump: Pumps provide the means for moving water through the system at usable working pressures. The operation and maintenance of these pumps are some of the most important duties for many water utility operators.

Sensing And Response Unit

Receiving unit contains several electronic elements as follows:

- Microcontroller (Arduino), DHT11 temperature and humidity sensor, Soil moisture sensor, LDR light sensor, DC fans, DC motor,valve
- **DHT11 sensor** : Have needed for reading the temperature and humidity in the Greenhouse.
- **Grove Light sensor**: Have needed for reading the light density in the Greenhouse.
- **Soil Moisture sensor**: Have needed for reading water level in soil.
- **DC fan**: Have needed for ventilation in greenhouse if the temperature is increase above and humidity is increase the needed of the plant.
- **Water pump**: Have needed for pumping water (which replaced by green LED) in Greenhouse if the relative humidity is decrease the needed of the plant.
- **Relay**: The relay driver is used to isolate both the controlling and the controlled device. The relay is an electromagnetic device, which consist of solenoid, moving contacts (switch) and restoring spring and consumes comparatively large amount of power. Hence it is possible for the interface IC to drive the relay satisfactorily. To enable this, a driver circuitry, which will act as a buffer circuit, is to be incorporated between them. The driver circuitry senses the presence of a “high” level at the input and drives the relay from another voltage source. Hence the relay is used to switch the electrical supply to the appliances.

SOFTWARE REQUIREMENTS

6.1 ARDUINO IDE

Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension .ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom right-hand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

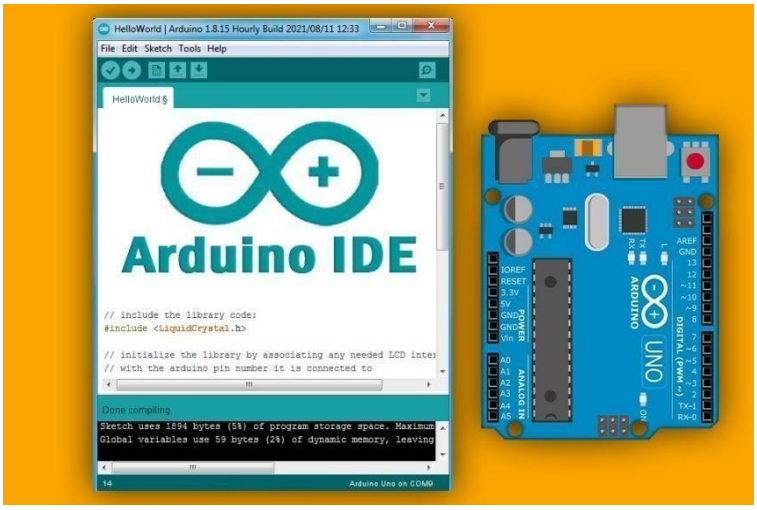


Fig6.1 Arduino IDE

Coding Details

```
#include <DHT.h>

#define DHTPIN 12     // Digital pin connected to the DHT sensor
#define DHTTYPE DHT11    // DHT 11

DHT dht(DHTPIN, DHTTYPE);

const int relayPin = 13; // Digital pin connected to the relay module
int sensorPin = A2; // Analog pin A0 for MQ-135 sensor
float sensorValue; // Variable to store sensor reading
float ppm; // Parts per million of detected gas (CO2)
int water; // variable to store moisture level
const int lightSensorPin = A5; // Analog pin for the sensor
```

```
void setup() {
  Serial.begin(9600);
  dht.begin();
  pinMode(relayPin, OUTPUT);
}

// Function to convert sensor value to ppm (example calibration)
float analogToPpm(int rawValue) {
  // You will need to calibrate this conversion based on your sensor
  float ppmValue = map(rawValue, 0, 1023, 0, 5000); // Example mapping
  return ppmValue;
}


void loop() {
  delay(2000); // Delay between sensor readings

  float temperature = dht.readTemperature(); // Reading temperature in Celsius

  if (isnan(temperature)) {
    Serial.println("Failed to read from DHT sensor!");
    return;
  }

  Serial.print("Temperature: ");
  Serial.println(temperature);

  // Check temperature and control the fan via relay
  if (temperature > 25.0) {
    digitalWrite(relayPin, HIGH); // Turn on the fan
    Serial.println("Fan turned ON");
  } else {
    digitalWrite(relayPin, LOW); // Turn off the fan
    Serial.println("Fan turned OFF");
  }

  sensorValue = analogRead(sensorPin); // Read sensor value (0-1023)

  // Calculate ppm of CO2 using sensor calibration and values
  ppm = analogToPpm(sensorValue); // You need to define this function

  Serial.print("CO2 Concentration: ");
  Serial.print(ppm);
  Serial.println(" ppm");

  delay(500); // Delay for stability (adjust as needed)

  water = digitalRead(6); // reading the signal from the soil sensor
  if (water == HIGH) {
    digitalWrite(3, HIGH); // turn on the relay (motor on)
```

```
    Serial.println("Moisture Level: Low  | Motor: ON"); // print moisture level
and motor status
  } else {
    digitalWrite(3, LOW); // turn off the relay (motor off)
    Serial.println("Moisture Level: Full | Motor: OFF"); // print moisture level
and motor status
  }

  delay(500); // delay for 5 seconds before the next iteration

  int sensorValue = analogRead(lightSensorPin); // Read the sensor value

  Serial.print(":Light Intensity Value: ");
  Serial.println(sensorValue); // Print the sensor value to the serial monitor

  delay(5000); // Delay to slow down the output (optional)
}
```

RESULT ,OUTPUT

Climate is controlled by the Arduino as giving signals to the Relays. Relays will enable the motors and fans which will work to resolve the climate.

The Project of "Climate Controlled Greenhouse By Arduino" has been completed successfully.

The output on the LCD has shown below

CONCLUSION

It is our great pleasure that we have successfully completed our project that presents a design of a simple and low cost monitoring and control greenhouse system based on an Arduino technology. A temperature, humidity, soil moisture and light sensors were integrated with fan and pump to figure out the sensing and responding unit. Arduino UNO and serial interface were utilized to be the processing and communication units respectively.The proposed displaying and controlling via relays promises lower running costs, and increase flexibility and reliability in a greenhouse management system. Compatibility, compactness, portability and low power consumption is some of important key elements in our design. Therefore a carefully selection of sensing devices and circuitry components is also very important especially when interfaced to the microcontroller. The management scenario of the entire environment of the greenhouse has a crucial importance in utilizing the attached responding elements, where the logical relation between them should be studies firstly.

FUTURE SCOPE

The following improvements can be recommended for possible future work:

- More sensors can be added to the sensing unit to monitor other environmental parameters such as soil pH level, air flow, carbon monoxide and oxygen level.
- Global system for mobile communication and SMS can also be integrated into the system. These extra features will allow the system to directly alert the user of any abnormal changes in the greenhouse environment through the transmission of a simple short texts message.
- Design Android application for monitoring and controlling the greenhouse form the smart mobile.
- Using wireless sensor for sensing and transmit the value of the greenhouse parameters to the processing unit

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