INDOOR SMART GARDEN SYSTEM

Submitted By :

1. NALLAMOTHU DHARANIJA 20BCE7360
2. VEMULAPALLI AASRITHA SAI 20BCE7074
3. CHAPARALA SRI MANASA 20BCE7345
4. RAVULA RATNA SUJITHA 20BCE7438
5. K LAALASA 20BCI7036
6. S GOWTHAM NARAYANA 20BCD7172

Under the Guidance of :

Prof.Siddique Ibrahim Peer Mohamed

Department of Computer Science and Engineering

VIT – AP UNIVERSITY

VIT-AP University, Inavolu, Andhra Pradesh – 522237

ABSTRACT

The main aim of the project is to develop techniques in agriculture automation to flourish and deliver its full potential. This system designed by using arduino nano microcontroller to overcome limitations of agriculture farming about supplying of water to plants by drip system with the available water tables. In our system we use Arduino microcontroller, motor pump, soil moisture sensor.

Smart gardening uses technology to provide and manage light and water, monitor nutrients, and control weeds. These devices can connect to your smart home systems and your phone. With home garden automation, you can save energy and effort while producing food or decorative plants. Smart garden technology is a fast-growing field that's changing everything from large-scale farming to window box herb gardens. People are using smart gardening devices because energy-efficient gardens are great for the environment and the bank account.

A vegetable or herb garden that is controlled by computer. Although farming and gardening have been enhanced with computers and electronic devices for decades, the smart garden often refers to small, indoor units that by various means determine when to alert the user to add nutrients. Smart gardens may also manage their own lighting.

With home garden automation, one can save energy and effort while producing food or decorative plants. Even without any outdoor space, one can grow plants indoors. Indoor garden systems can open up a lot of possibilities for gardeners. They are easy to use and produce great results. The system creates ideal climate conditions necessary for growth, providing exactly the amount of light and nutrients that a plant needs.

People are using smart gardening devices because energy-efficient gardens are great for the environment. Automating your garden using smart gardening devices cuts out much of the daily work and responsibility, leaving the users with all of the benefits .

Keywords: Arduino, soil moisture, temperature, motor pump, nutrients.

Index :

INTRODUCTION

Smart Garden System automatically waters garden or plants. This system is very smart because it knows every detail of soil like Soil Moisture, Soil Humidity & Soil Temperature. And after knowing every detail, it will automatically control the watering system without any human interference.

Smart gardening uses technology to provide and manage light and water, monitor nutrients, and control weeds. These devices can connect to your smart home systems and your phone. With home garden automation, you can save energy and effort while producing food or decorative plants. Smart garden technology is a fast-growing field that's changing everything from large-scale farming to window box herb gardens. People are using smart gardening devices because energy-efficient gardens are great for the environment.

Smart Garden system creates ideal climate conditions necessary for growth, providing exactly the amount of light and nutrients that a plant needs.

Automating your garden using smart gardening devices cuts out much of the daily work and responsibility, leaving the users with all of the benefits like :

1. **Added convenience:**
   Gardening can be a chore. With smart gardening devices, one can automate much of it.
2. **Improved energy efficiency**
   You can improve energy efficiency in the summer by optimizing to conserve power and water usage.
3. **Fresh food and flowers**
   Nothing beats homegrown for freshness and quality, not to mention affordability. A home garden puts healthy food on the table at a fraction of the store-bought cost.
4. **Better productivity**
   Because smart gardening optimizes everything plants need to thrive, you'll get a better yield, whether you're growing vegetables or flowers.

BACKGROUND

Irrigation is the main problem in agriculture in the countries which are in developing stage. The main cause is low rainfall due to this more land is not irrigated. Another very important reason is unplanned usage of water resources by this way more water gets wasted. Smart Garden system can supply water to plants whenever they are in need of water at regular power supply intervals.

Waters plants at exact time based on soil condition which will improve crop growth by taking water and minerals from soil when needed. The aim of the project is to create a sensor network based on low - cost soil moisture, temperature monitoring system which helps to track the moisture of the soil and temperature in real time and allow water to the plants based on the detecting values and the type of crop.

So , We need not worry about the necessities of the plant as everything's monitored and provided when needed like light , water etc.

Problem Definition:

Growing crops is quite a tedious task. The demand for this task has increased with the need for more food due to increase in population. In traditional farming, farmers have to visit the farming land regularly to measure the various environmental parameters such as temperature, humidity, light intensity and soil moisture to cultivate the crops healthily. Even though this system of traditional farming has been used for years, the system is strenuous and fails to give a high productivity as farmers usually are unable to measure all parameters accurately all the time. Hence there arises a need to have an automatic system that will monitor and control the plant parameters for efficient growth. Automatic garden monitoring and controlling is a way where all the parameters are automatically monitored without any human support. In our system, we use Arduino microcontroller which controls and monitors temperature, humidity and soil moisture through sensors and activates cooling fans, bulb, and motor to pump water respectively, in case of requirement. Information will be sent to the agriculturist or gardener, in case of any abnormal situation through an android app and the solution will be provided accordingly. The proposed system targets a smart way of monitoring the plant growth using automation and an Android app to monitor it. The use of an app technology through smartphones enables the system to reach out to many people as well. The main theme of this paper is to increase the plant yield and produce by improving the plant growth conditions through low water consumption by providing an automatic watering system, thereby saving a good amount of energy and resources as well. With the advancement of technology, plants are hence better monitored, nourished and grown healthily.

Objectives:

The main objective is to create ideal climate conditions necessary for growth, providing exactly the amount of light, water and nutrients that a plant needs. To build a sunlight emulator, irrigation system, and climate controller wrapped into one elegant and modern design. The system will be based on the soil moisture to plant and watering, and to achieve the following objectives:

• Soil moisture will observe if the plants need water or not based on if the soil wet or dry.

• Water pump automatically waters the plant when the moisture of soil is less than required value based on data recieved by the sensor

• To provide sufficient amount of light to the plants in the smart garden

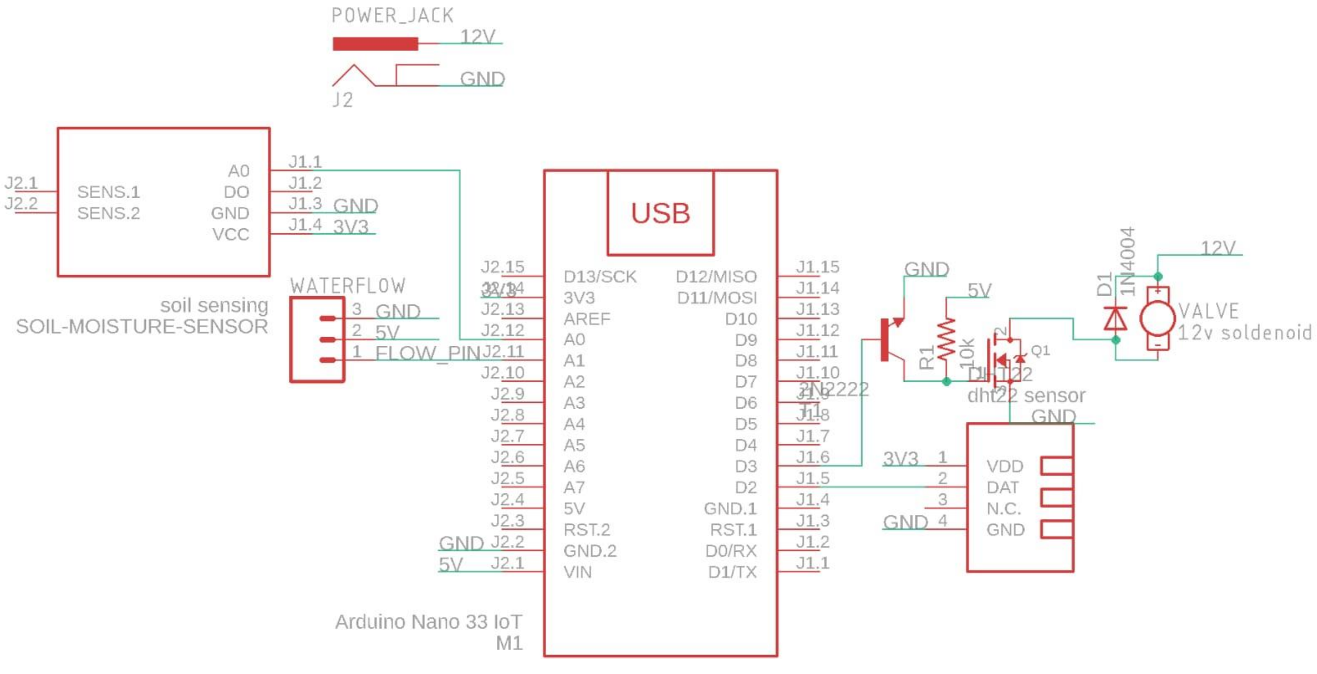
Methodology/Procedure

For creating a smart garden system we have considered Arduino Nano. We have connected the Arduino nano, light sensor, Moisture sensor, temperature, humidity sensors and an OLED display to the breadboard. Necessary connections were made, using the jumper wires, between all the components to work in the required manner and to show the output values in the OLED display. To complete the connections we also used relay modules and a water motor. Download the Arduino software, then write the codes for the generated hardware.

We have taken an airtight container, placed some soil on three different plates, and sprinkled some seeds. Later we attached the breadboard to the container. Then dipped the moisture sensor and the water pump into the soil to check the working of the moisture sensor and the accuracy of the codes. Now attach the LEDs to the container and connect it to a battery which we can switch on and off using a battery clip, to provide the required amount of light to the plant to make chlorophyll. Observe the working of the light sensor. According to the temperature and humidity in the container, the fan gets turned on, to adjust the atmosphere in the container for plant growth.

So, whenever the humidity increases, the fan gets turned on to cool it down. According to the moisture levels in the soil, the water gets released into the soil. The lights will be on according to the optimal light that is required for plant growth.

This is how we grow plants automatically without any human effort and save resources by providing them only in the required amounts.



CIRCUIT DIAGRAM

Results and Discussion:

The smart automated garden monitoring and control using Arduino with sensor technology is proposed, simulated, and tested. Agriculturists or gardeners can utilize and implement this system, to control and monitor all parameters such as temperature, humidity, soil moisture, and light intensity. This system is designed not only to monitor the plants but also for the healthier growth of plants without wastage of water and is successfully controlled remotely through mobile applications in our personal devices. The optimal environment provided by these sensors results in better growth and productivity. In the future, the work can be improved with image processing technology to monitor plant diseases with the variation that occurs with the leaves and stems.

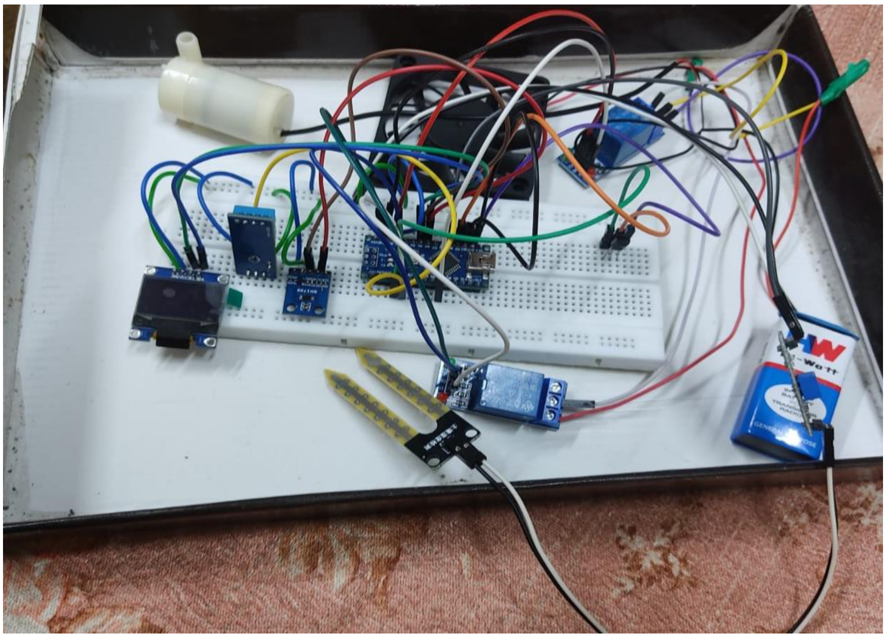


Figure 1

This is the final view after connecting all the sensors

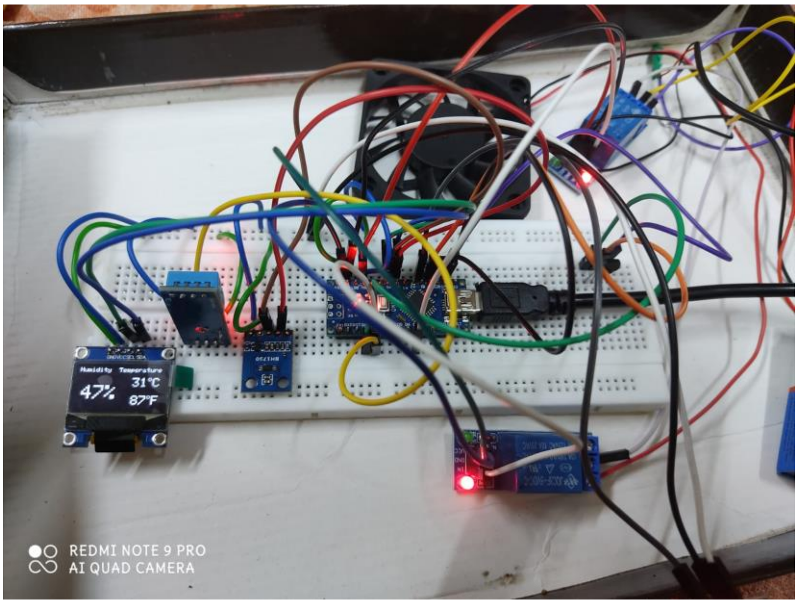


Figure 2

Here in this picture we can observe the readings of all the temperature humidity sensors

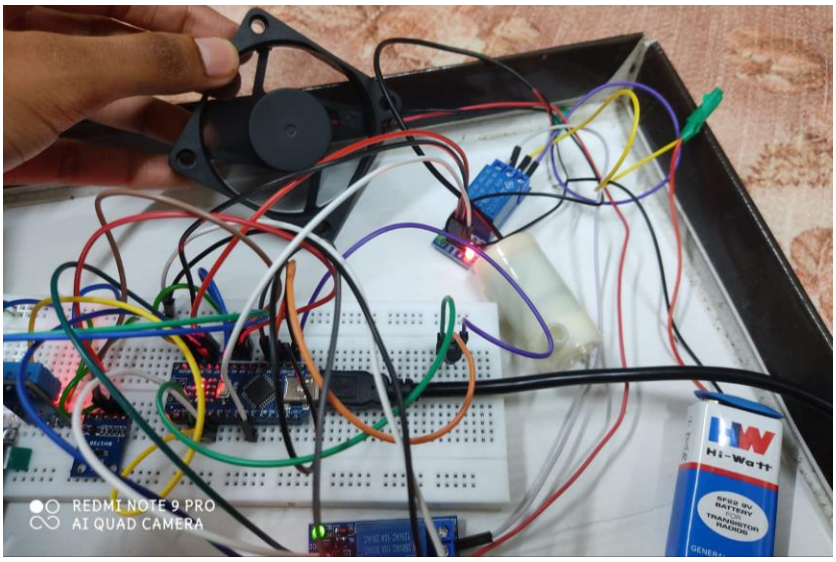


Figure 3

This is the view of temperature control fan running when it is reaching the temperature bound

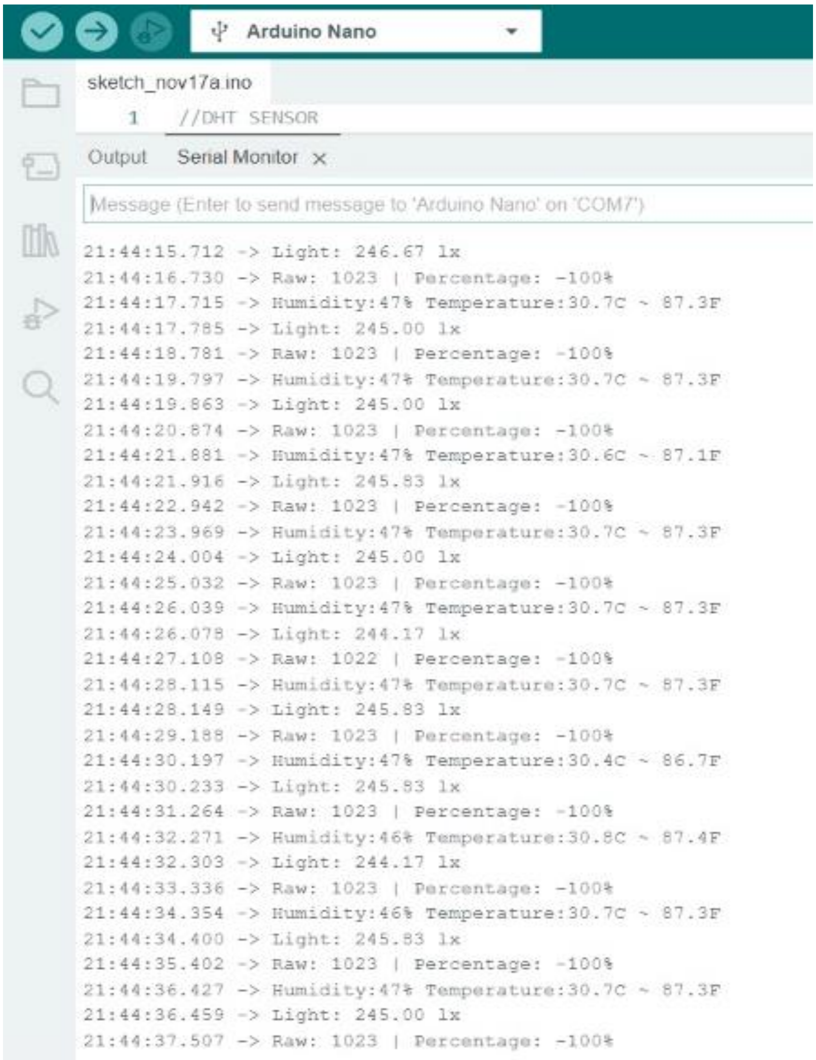


Figure 4

Figure 5

These are the output reading of temperature and humidity, soil moisture, light intensity sensors

Figure 6

This is the view of when automatic watering for plants is going on.

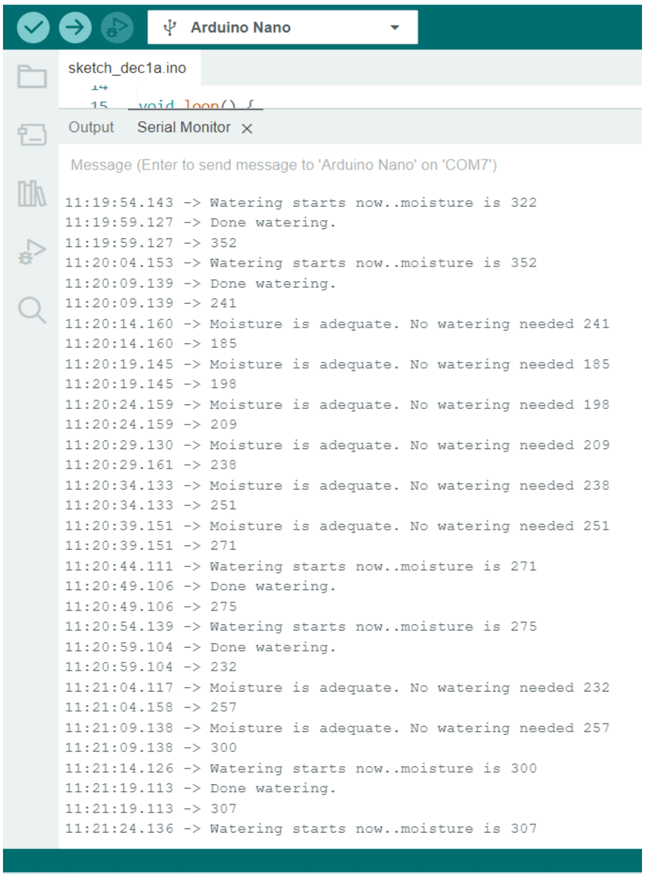


Figure 7

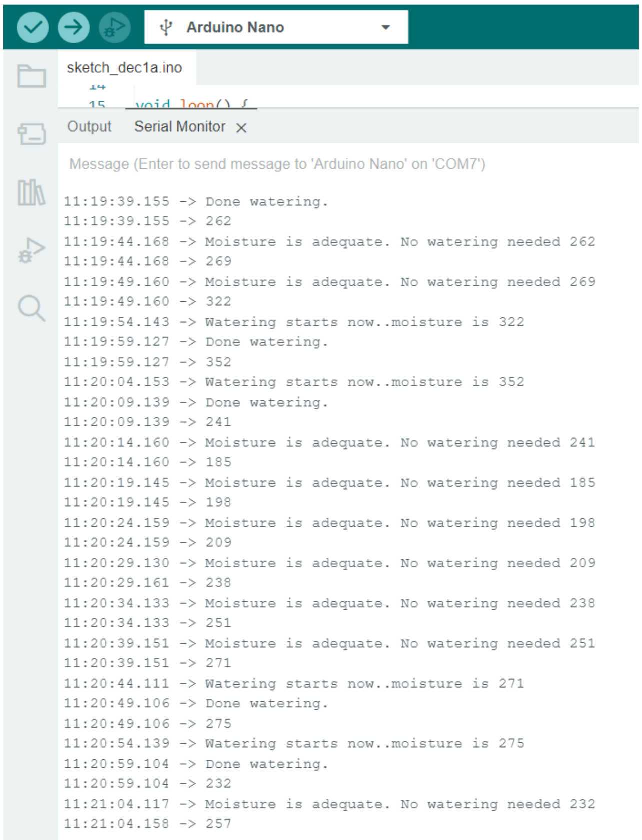


Figure 8

These are some output readings when watering is going on.

Conclusion:

Smart Gardening System using the proper control unit such as Arduino board which will help to ease the most tedious job and tasks of gardening for farmers and plants lovers who always looking to care about their plants and stay updated with their progress. This design aims to monitor various garden parameters, perform watering process.

This system also helps to solve many issues occurring in the existing plant watering and gardening system. Through the soil moisture sensor to detecting the humidity level, system will decide the need to run irrigation process, so system helps to save water which means utilization for bills and save water sources. Plant monitoring and smart gardening proposed in this design with the help of microcontroller and proper sensors such as soil moisture will bring more convenience and comfort to people's lives for taking care of their garden.

The microcontroller that has been used in the system Arduino which will provide an economic and efficient platform to implement and perform the desired functions such as plant monitoring and smart gardening operations. The main advantage of the smart gardening system is that the user can manage the gardening process easily and can be updated with the status of the plants whenever necessary.

Future Scope:

The concept of plants monitoring, and smart gardening is far more than observing crops or just manage watering process as clarified in the project definition. The future works of the smart gardening that we are planning to perform are using the proper components that fit to the project requirements and which will make a significant change in the way of traditional planting process, Monitor the environment of the garden will be available for the user.The system as planned will be able to monitor, observe, planting, watering, and notify users with the required status information. Also, monitoring the plant when get ripened and ready to be picked up, in addition to notify the user with the status of the plants in the garden. This might be as future work of the project, so farmer or garden owner can stay connected to the garden and the plants as if farmer physically exist.

References:

https://create.arduino.cc/projecthub/patelDeep/smart-garden-cda82f

https://create.arduino.cc/projecthub/smart-boys/smart-garden-2dd7b0

https://create.arduino.cc/projecthub/londonium2021/lazy-indoor-garden-9ea453

https://ieeexplore.ieee.org/abstract/document/9077615

Codes:

//Code to read the temperature and humidity values and display on oled and light intensity, soil moisture value in output

```
//DHT SENSOR
#include "DHT.h"
#define DHT11Pin 2
#define DHTType DHT11
//OLED
#include <Wire.h>
#include <Adafruit_GFX.h>
#include <Adafruit_SSD1306.h>
#include <BH1750.h>
BH1750 lightMeter;
DHT HT(DHT11Pin,DHTType);
float humi;
float tempC;
float tempF;

//OLED define
#define SCREEN_WIDTH 128 // OLED display width, in pixels
#define SCREEN_HEIGHT 64 // OLED display height, in pixels
// Declaration for an SSD1306 display connected to I2C (SDA, SCL pins)
Adafruit_SSD1306 display(SCREEN_WIDTH, SCREEN_HEIGHT, &Wire, -1);
int analogPin = A1;
int moisture;
int percentage;

int map_low = 686;
int map_high = 350;
void setup()
{
 Serial.begin(9600);
 Wire.begin();
 // On esp8266 you can select SCL and SDA pins using Wire.begin(D4, D3);

 lightMeter.begin();

 Serial.println(F("BH1750 Test begin"));
 HT.begin();
 if(!display.begin(SSD1306_SWITCHCAPVCC, 0x3C)) // Address 0x3C for 128x64
 {
  Serial.println(F("SSD1306 allocation failed"));
  for(;;);
 }
 delay(1000);
 display.clearDisplay();
}

void loop()
{
```

```
  float lux = lightMeter.readLightLevel();
  Serial.print("Light: ");
  Serial.print(lux);
  Serial.println(" lx");
  delay(1000);
  moisture = analogRead(analogPin);
  Serial.print("Raw: ");
  Serial.print(moisture);

  percentage = map(moisture, map_low, map_high, 0, 100);

  Serial.print(" | Percentage: ");
  Serial.print(percentage);

  Serial.println("%");
 delay(1000);
 humi  = HT.readHumidity();
 tempC = HT.readTemperature();
 tempF = HT.readTemperature(true);

 Serial.print("Humidity:");
 Serial.print(humi,0);
 Serial.print("%");
 Serial.print(" Temperature:");
 Serial.print(tempC,1);
 Serial.print("C ~ ");
 Serial.print(tempF,1);
 Serial.println("F");

 display.clearDisplay();
 oledDisplayHeader();


 oledDisplay(3,5,28,humi,"%");
 oledDisplay(2,70,16,tempC,"C");
 oledDisplay(2,70,44,tempF,"F");

 display.display();
}


void oledDisplayHeader()
{
 display.setTextSize(1);
 display.setTextColor(WHITE);  //WHITE
 display.setCursor(0, 0);
 display.print("Humidity");
 display.setCursor(60, 0);
 display.print("Temperature");
}
```

```
void oledDisplay(int size, int x,int y, float value, String unit)
{
 int charLen=12;
 int xo=x+charLen*3.2;
 int xunit=x+charLen*3.6;
 int xval = x;
 display.setTextSize(size);
 display.setTextColor(WHITE);

 if (unit=="%")
 {
   display.setCursor(x, y);
   display.print(value,0);
   display.print(unit);
 } else
 {
   if (value>99)
   {
    xval=x;
   } else
   {
    xval=x+charLen;
   }
   display.setCursor(xval, y);
   display.print(value,0);
   display.drawCircle(xo, y+2, 2, WHITE);  // print degree symbols (  )
   display.setCursor(xunit, y);
   display.print(unit);
 }
}

//Automatic plant watering based on the moisture percentage present

// if the soil is dryer than this number, then start watering
const int dry = 270;

const int pumpPin = 7;//relay pin
const int soilSensor = A1;

void setup() {
  pinMode(pumpPin, OUTPUT);
  pinMode(soilSensor, INPUT);
  Serial.begin(9600);
  digitalWrite(pumpPin, HIGH);
  delay(5000);
}

void loop() {
  // read current moisture
  int moisture = analogRead(soilSensor);
  Serial.println(moisture);
  delay(5000);
```

```
  if (moisture >= dry) {
    // the soil is too dry, water!
    Serial.println("Watering starts now..moisture is " + String(moisture));
    digitalWrite(pumpPin, LOW);

    // keep watering for 5 sec
    delay(5000);

    // turn off water
    digitalWrite(pumpPin, HIGH);
    Serial.println("Done watering.");
  } else {
    Serial.println("Moisture is adequate. No watering needed " + String(moisture));
  }
}
//temperature control fan using arduino

#include "DHT.h"
#define DHT11Pin 2
#define DHTType DHT11
DHT HT(DHT11Pin,DHTType);
int relay_pin = 2;

void setup() {
sensor.begin();
pinMode(relay_pin, OUTPUT);
digitalWrite(relay_pin, HIGH);
}
void loop() {
float t = sensor.readTemperature(); //reading the temperature from the sensor
// Checking if the sensor is sending values or not
if (isnan(t)) {
Serial.println("Failed");
delay(1000);
return;
}
Serial.println("Temp: ");
Serial.println(t);
Serial.println(" C");
if (t > 35){
  digitalWrite(relay_pin, LOW);
  Serial.println("Fan is ON ");
  delay(10);
}
else{
  digitalWrite(relay_pin, HIGH);
  Serial.println("Fan is OFF ");
}
delay(2000);
}
```