Indoor Plant Unit:
A Solution for Efficient Plant Care

Introduction

The Indoor Plant Unit is an automated system designed to assist individuals in taking care of their indoor plants. The system utilizes sensors that measure the soil moisture, light, and temperature levels of plants and automatically controls a water pump, LED lights, and a fan to maintain the ideal growing conditions for indoor plants. This project report provides an overview of the Indoor Plant Unit, highlighting the unique features, components used, workshop processes employed, and the results achieved.

Project Group

The Indoor Plant Unit has been designed by Hansal Kachhara (E22MECU0002) and Vishal Asrith Valaboju (E22MECU0011) in Second Semester for EMEC114P.

Components Used

The Indoor Plant Unit comprises several components

1. Arduino Uno
2. Soil moisture sensor
3. LDR sensor
4. Temperature sensor
5. Relay modules (3)
6. 12V water pump
7. 12V LED lights
8. 12V fan
9. LCD display
10. Micro SD card module
11. Silicon Glue
12. M-Seal
13. Acrylic Sheet Cutter
14. B-7000 glue

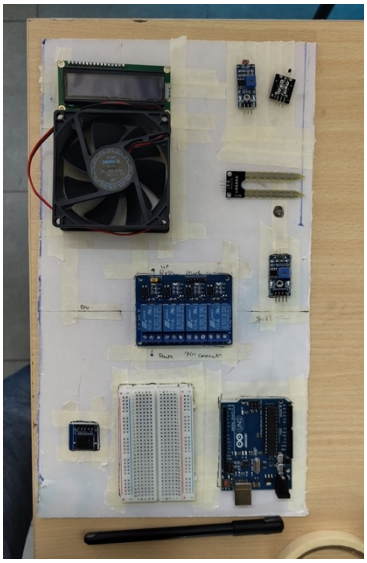
Workshop Process Employed

The fabrication of the Indoor Plant Unit involved several workshop processes, including scoring and breaking acrylic sheet, drilling holes in acrylic sheets, filing the corners of the acrylic sheet, and using a hacksaw to cut the acrylic sheet.

1. Scoring and Breaking Acrylics Sheet: Scoring and breaking an acrylic sheet is a technique used to cut the sheet into smaller pieces. This process involves making a shallow cut on the surface of the sheet with a sharp tool, such as a scoring knife or a glass cutter, and then applying pressure to the scored line to snap the sheet along the line. The technique requires precision and control to avoid cracking or chipping the sheet.

2. Drilling Holes in Acrylic Sheets: Drilling holes in acrylic sheets requires special care and attention to prevent cracking or melting of the material. It's important to use a drill bit designed specifically for use on plastics, and to drill at a slow speed while applying a consistent, gentle pressure. Additionally, it's important to support the sheet firmly during the drilling process to prevent it from bending or breaking.
3. Filing the Corners of an Acrylic Sheet: Filing the corners of an acrylic sheet is a finishing process used to smooth out any sharp edges or corners left after cutting or drilling the sheet. It's important to use a file designed for use on plastics and to file gently and slowly, making sure to maintain a consistent angle to avoid any irregularities or unevenness.
4. Using a Hacksaw to Cut an Acrylic Sheet: Using a hacksaw to cut an acrylic sheet is a suitable option when a straight, clean cut is required, such as for cutting rectangular shapes. However, it's important to use a fine-toothed blade and to cut slowly and steadily, using a guide to ensure a straight line. It's also important to avoid applying too much pressure, which can cause the sheet to crack or splinter.

Assembly Process



The assembly of the Indoor Plant Unit requires connecting the sensors and modules to the Arduino Uno board. The soil moisture sensor is connected to analog pin A0 of the Arduino Uno, while the LDR sensor and temperature sensor are connected to analogy pins A1 and A2, respectively. The VCC and GND pins of all the sensors are connected to the 5V and GND pins of the Arduino Uno board, respectively. The signal pins of the relay modules are connected to digital pins 8, 9, and 10 of the Arduino Uno board. The 12V water pump, LED lights, and fan are connected to the relay modules. The LCD display is connected to the I2C pins (SDA and SCL) of the Arduino Uno

board, while the micro SD card module is connected to the SPI pins (MISO, MOSI, SCK, and CS) of the board. The micro SD card is inserted into the micro SD card module. A 12V DC power supply is required to power the Indoor Plant Unit, and it can be connected to the VIN and GND pins of the Arduino Uno board.

Unique Feature

One of the unique features of the Indoor Plant Unit is that it stores all data in an SD card placed in the system. This data can be further used by other researchers and scholars to study about a particular plant. This feature sets the Indoor Plant Unit apart from other similar systems in the market, as it allows individuals to contribute to research studies by collecting and sharing data on plant growth and development.

Code

```
#include <Wire.h>
#include <LiquidCrystal_I2C.h>
#include <SD.h>

//Constants
const int hygrometerPin = A0;
const int ldrPin = A1;
const int tempPin = A3;
const int waterPumpPin = 8;
const int ledPin = 9;
const int fanPin = 10;
const int chipSelect = 4;

//Variables
bool isWatering = false;
bool isLightOn = false;
bool isFanOn = false;
```

```
LiquidCrystal_I2C lcd(0x27, 16, 2);

void setup() {
  Serial.begin(9600);
  pinMode(waterPumpPin, OUTPUT);
  pinMode(ledPin, OUTPUT);
  pinMode(fanPin, OUTPUT);
  lcd.init();
  lcd.backlight();
  if (!SD.begin(chipSelect)) {
    lcd.print("SD Card Error");
    while (1);
  }
  File dataFile = SD.open("data.txt", FILE_WRITE);
  if (dataFile) {
    dataFile.println("Plant Data:");
    dataFile.close();
  }
}

void loop() {
  int hygrometerValue = getHygrometerValue(hygrometerPin);
  int ldrValue = getLdrValue(ldrPin);
  float tempValue = getTemperature(tempPin);

  if (hygrometerValue < 40) {
    waterPlant();
  }
  else {
    stopWatering();
  }

  if (ldrValue >= 5000 && !isLightOn) {
    turnOnLight();
  }
  else if (ldrValue < 5000 && isLightOn) {
    turnOffLight();
  }

  if (tempValue >= 35 && !isFanOn) {
    turnOnFan();
```

```
  }
  else if (tempValue < 35 && isFanOn) {
    turnOffFan();
  }

  displayData(hygrometerValue, ldrValue, tempValue);
  writeDataToFile(hygrometerValue, ldrValue, tempValue);

  // Print data to serial monitor
  Serial.print("Hygro:");
  Serial.print(hygrometerValue);
  Serial.print("% ");
  Serial.print("LDR:");
  Serial.print(ldrValue);
  Serial.print(" ");
  Serial.print("Temp:");
  Serial.print(tempValue);
  Serial.print("C ");
  Serial.print("Fan:");
  Serial.print(isFanOn ? "ON " : "OFF ");
  Serial.print("Pump:");
  Serial.print(isWatering ? "ON " : "OFF ");
  Serial.print("LED:");
  Serial.println(isLightOn ? "ON " : "OFF ");

  delay(5000);
}

int getHygrometerValue(int pin) {
  int value = analogRead(pin);
  value = constrain(value, 400, 1023);
  value = map(value, 400, 1023, 100, 00);
  return value;
}

int getLdrValue(int pin) {
  int value = analogRead(pin);
  return value;
}

float getTemperature(int pin) {
```

```
  int Vo = analogRead(pin);
  float R2 = 10000 *( (float)Vo/500.0);
  float logR2 = log(R2);
  float temp = (1.0 / (0.001129148 + (0.000234125 * logR2) + (0.0000000876741 * logR2 *
logR2 * logR2)))- 273.15;
  return temp;
}

void waterPlant() {
  digitalWrite(waterPumpPin, HIGH);
  isWatering = true;
}

void stopWatering() {
digitalWrite(waterPumpPin, LOW);
isWatering = false;
}

void turnOnLight() {
digitalWrite(ledPin, HIGH);
isLightOn = true;
}

void turnOffLight() {
digitalWrite(ledPin, LOW);
isLightOn = false;
}

void turnOnFan() {
digitalWrite(fanPin, HIGH);
isFanOn = true;
}

void turnOffFan() {
digitalWrite(fanPin, LOW);
isFanOn = false;
}

void displayData(int hygroValue, int ldrValue, float tempValue) {
lcd.setCursor(0, 0);
lcd.print("Hy:");
```

```
lcd.print(hygroValue);
lcd.print("% ");
lcd.print("LDR:");
lcd.print(ldrValue);
lcd.setCursor(0, 1);
lcd.print("Temp:");
lcd.print(tempValue);
lcd.print("C  ");
lcd.println("HK ");
}

void writeDataToFile(int hygroValue, int ldrValue, float tempValue) {
File dataFile = SD.open("data.txt", FILE_WRITE);
if (dataFile) {
dataFile.print("Hygro:");
dataFile.print(hygroValue);
dataFile.print("% ");
dataFile.print("LDR:");
dataFile.print(ldrValue);
dataFile.print(" ");
dataFile.print("Temp:");
dataFile.print(tempValue);
dataFile.print("C ");
dataFile.print(isFanOn ? "Fan: ON" : "Fan: OFF");
dataFile.print(isWatering ? "Fan: ON" : "Fan: OFF");
dataFile.print(isLightOn ? "Fan: ON" : "Fan: OFF");
dataFile.println();
dataFile.close();
}
}
```

Results Achieved

The Indoor Plant Unit has been successfully designed, fabricated, and has been found to be an efficient solution for indoor plant care. The system can automatically control the water pump, LED lights, and fan to maintain the ideal growing conditions for plants, based on the readings from the sensors. The LCD display provides real-time updates on the moisture, light, and temperature levels of the plants, while the micro SD card stores all the data for future analysis. The system can be easily customized to suit different plant types. The Indoor Plant Unit can also be used to monitor the health and growth of plants in research studies, and it can contribute to the development of new technologies and techniques for indoor plant care.

Future Scope

The Indoor Plant Unit has a lot of potential for future development and improvements. One possible enhancement could be the addition of a pH sensor to monitor the acidity level of the soil, which is important for certain types of plants.

Another improvement could be the integration of a Wi-Fi module, which would allow for remote monitoring and control of the system through a mobile app or web interface. This would make it easier for users to keep track of their plants' progress and make adjustments as needed.

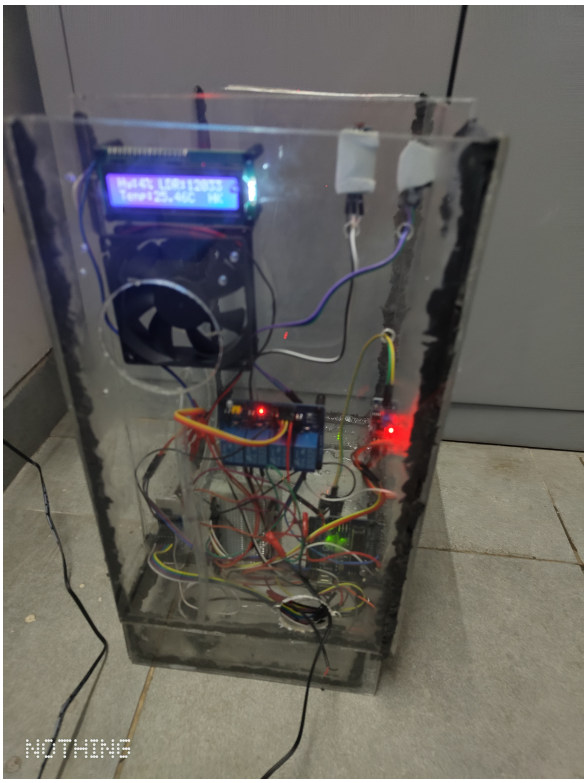
The Indoor Plant Unit can also be used for research purposes. Since the system logs all the sensor data onto a micro SD card, it can be used by researchers and scholars to study the growth patterns of various indoor plants. This could lead to a better understanding of how different plants respond to different growing conditions and help in developing more efficient and sustainable methods of indoor farming.

Conclusion

In conclusion, the Indoor Plant Unit is a unique and efficient solution for indoor plant care, designed to provide individuals with an automated system that can monitor and control the growing conditions for indoor plants. The system is easy to assemble and can be customized to suit different plant types, while the micro SD card feature allows for data collection and sharing for research studies. The Indoor Plant Unit can contribute to the development of new technologies and techniques for indoor plant care and can be a valuable tool for both individuals and researchers.

Images

Indoor Plant Unit



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