ROBOT GARDENER

Projecr CCAI-436 : Advanced Topics in Artificial Intelligence

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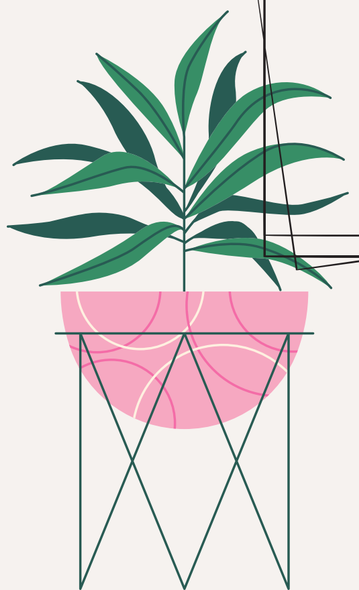
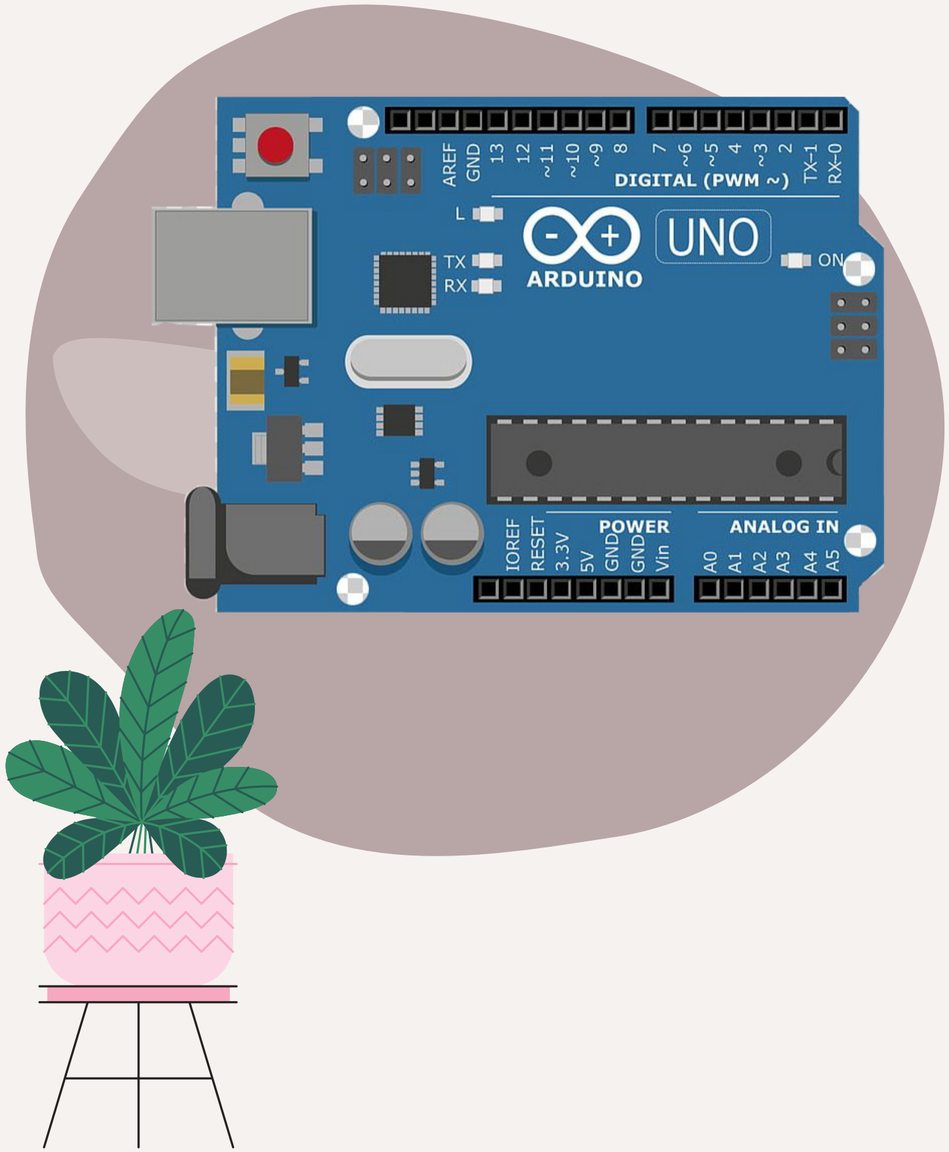




INTRODUCTION

Humans seek connection with nature because it improves their wellbeing. Studies about stress reduction theory show time spent in green spaces can reduce mental fatigue and increase relaxation. Which will in turn, increase our work performance and productivity.

However, taking care of plants requires patience and experience; because plants are very sensitive to the environment and the amount of water and sunlight they are provided with. Our system Robot Gardener provides the plant with a moderate amount of water and a stable source of light.

What is Robot Gardener?

Robot Gardener uses a soil moisture sensor to control the watering process while also providing light to the plant.

Controlling the watering process will protect the plant from various problems such as:

- roots rot
- leaf burns
- yellowing leaves

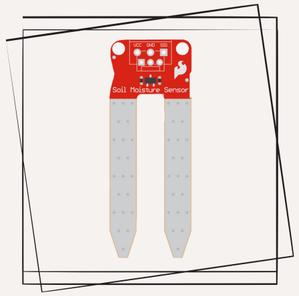
That are common symptoms of overwatering the plant.
While underwatering the plant can lead to:

- slow growth
- crisp and dropping leaves.

Locating the plant directly under the sun could scorch its leaves. And placing it somewhere with little light could hinder the plant's growth and, in some cases, it could lead the plant to stretch towards light.

Robot Gardener will protect the soil ecosystem while delivering water at optimal levels for the plant's growth.

The Main Parts

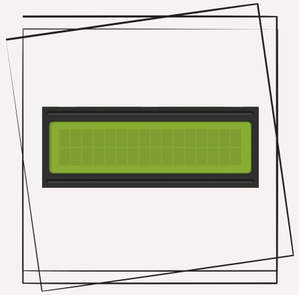


Soil Moisture Detector Sensor

Soil moisture sensor, sends readings to the Arduino.

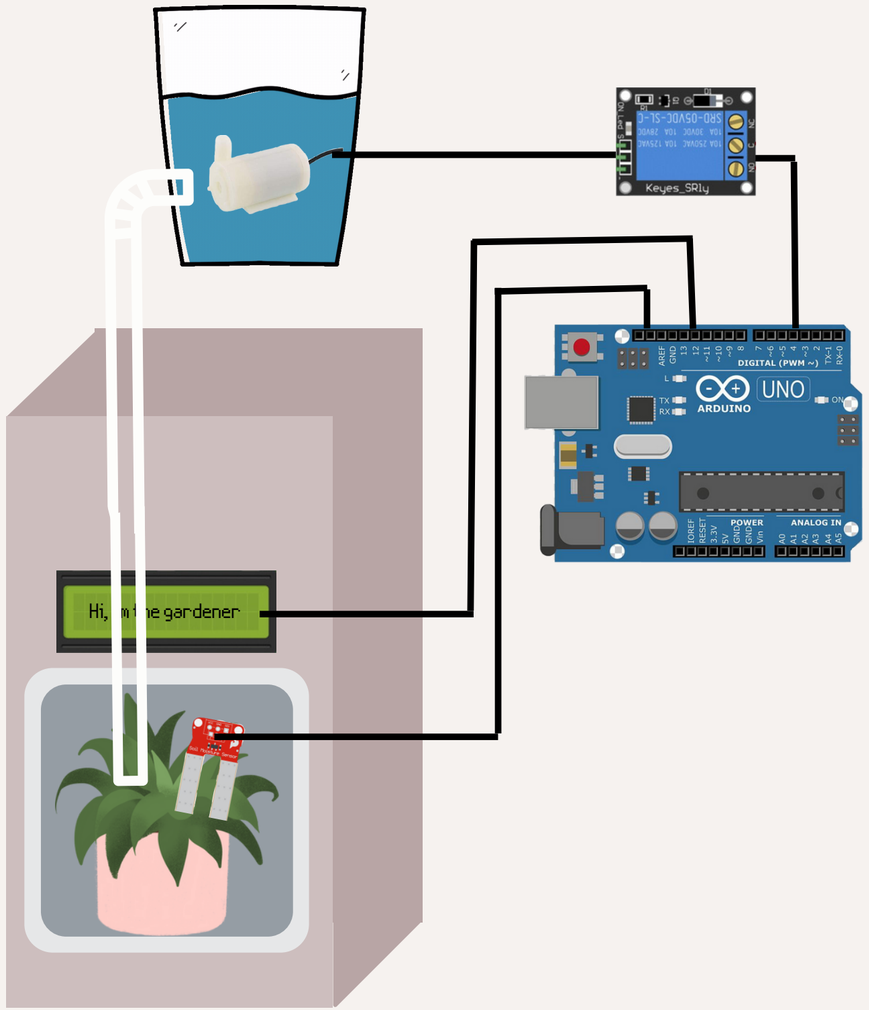
Water Pump

Small Submersible Water Pump (DC 3-4.5 Volts), connected to a relay.



LCD Display

16×2 LCD Blue Backlight Display with Driver Circuit.

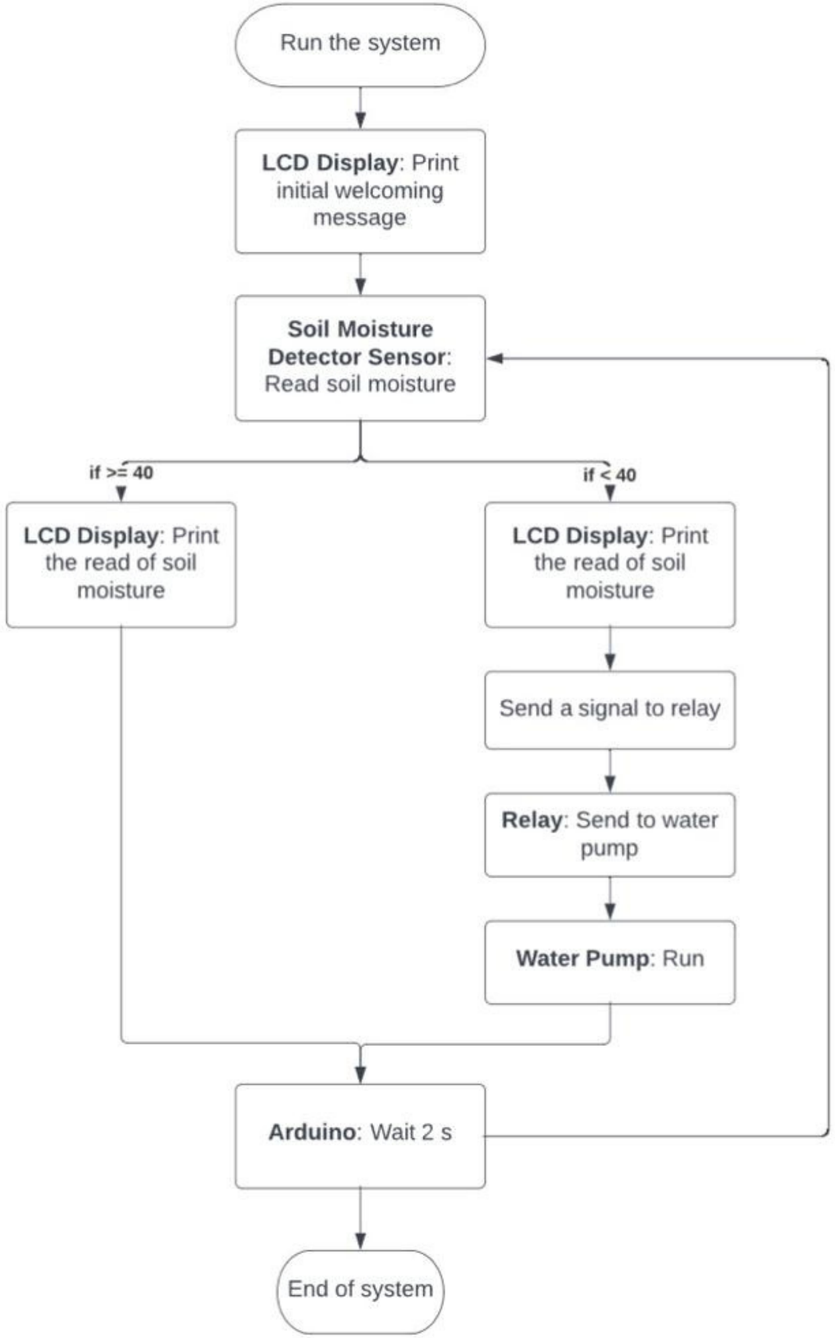


How does the Robot Gardener work?

The Arduino is connected to a moisture sensor and relay via a breadboard. The Moisture sensor takes multiple readings from the soil approximately every second and When the moisture sensor takes a reading that is less than 40% moisture content of the soil, the relay is triggered sending voltage to the water pump. Then the rate of change of moisture in printed on the LCD display.

It's possible to change the threshold value for moisture depending on the plant type, environmental conditions, etc.

Flowchart


Run the system
LCD Display: Print initial welcoming message
Soil Moisture Detector Sensor: Read soil moisture
if >= 40
if < 40
LCD Display: Print the read of soil moisture
LCD Display: Print the read of soil moisture
Send a signal to relay
Relay: Send to water pump
Water Pump: Run
Arduino: Wait 2 s
End of system

code :

```

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

byte smile[8] = {
  B00000,
  B00000,
  B01010,
  B00000,
  B10001,
  B01110,
  B00000,
  B00000
};

// Set the LCD address to 0x27 for a 16 chars and 2 line display
LiquidCrystal_I2C lcd(0x27, 16, 2);

// initialize the pins:
int relayPin = 3;
const int sensor_pin = A1;



void setup() {

  Serial.begin(9600);

  pinMode(relayPin,OUTPUT); //output pin for relay board, this will sent signal to the relay
  digitalWrite(relayPin,HIGH);

  lcd.init();// initialize the LCD
  lcd.setBacklight(1); // Turn on the blacklight and print a message.
  lcd.createChar(0, smile);

  lcd.setCursor(0, 0);
  lcd.print("Hi ");
  lcd.write(byte(0));// Display the custom character 0, the smile

  lcd.setCursor(0, 1);
  lcd.print("I'm the gardener");

  delay(5000);
  lcd.clear();


}
```

```

void loop() {

  float moisture_percentage = 0;
  int moisture = 0;

  //calculate the moisture of soil that comes from the sensor to the percentage
  moisture = analogRead(sensor_pin);
  moisture_percentage = ( 100 - ( (moisture/1023.00) * 100 ) );

  //print moisture_percentage to serial monitor
  Serial.print("Moisture Percentage = ");
  Serial.print(moisture_percentage);
  Serial.print("%\n\n");

  //print moisture_percentage to LCD display
  lcd.setCursor(0, 0);
  lcd.print("moisture ");
  lcd.print(moisture_percentage);
  lcd.print("%");


  //If the soil moisture is less than acceptable, turn on the pump until it returns to the acceptable degree
  while(moisture_percentage < 40){

      digitalWrite(relayPin,LOW); //low to proving signal and water
      Serial.println("Low moisture, needs watering.."); // for testing
      delay(100);

      digitalWrite(relayPin,HIGH); //HIGH to stop the signal and water
      delay(5000);

      moisture = analogRead(sensor_pin); // read the moisture of soil again to sure the plant got enough wat
      moisture_percentage = ( 100 - ( (moisture/1023.00) * 100 ) );

  }
  delay(2000);
  lcd.clear(); // clear the display unit

}
```

Robot Gardener Video:

Robot Gardener Image:

Robot Gardener Image:

Conclusion :

By providing light and water, our system kept the test plant healthy for more than 10 days. But different plants need different degrees of sun exposure. To make this system provide for more types of plants, we need to add means for the system to recognize the plant. This could be achieved by using image sensors and ai for plant recognition, or by allowing the user to choose the type of plant from a keypad. After the system learns what type of plant it’s taking care of, the system should know how much sunlight each type of plant needs so it can provide the right amount for it.

An autonomous plant caretaker will grow healthy, green plants and protect the soil ecosystem while saving water.

Thank you for listening.

any questions?

Resources:

https://www.missouribotanicalgarden.org/gardens-gardening/your-garden/help-for-the-home-gardener/advice-tips-resources/visual-guides/problems-common-to-many-indoor-plants

https://www.instructables.com/Arduino-Plant-Watering-System/?amp_page=true

https://youtu.be/hxYPV6E0CLY

https://www.tinkercad.com/

https://youtu.be/h6xy4Jv7GaQ

https://youtu.be/iwkE_HWU-6M

https://southernlivingplants.com/planting-care/a-gardeners-guide-to-sun-exposure/