EAST WEST UNIVERSITY

DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING

Course Code and Name EEE302 : Microprocessor and Interfacing Laboratory
Semester Summer, 2021
Name of The Project **Design a social impact based system built by microprocessor :** **Measure Soil Moisture**

Group Members	**Lab Instructor**
1. **Kazi Sadia** ID: 2019-1-80-077 2. **Mubeen Abdullah** ID: 2019-1-80-072 3. **Md. Mofazzal Hossain** ID: 2019-1-80-023	**Fakir Mashuque Alamgir** Assistant Professor Dept. of EEE East West University

Date of Report Submission 11 September, 2021

Abstract:

This report contains the overall concept of smart farming using Arduino UNO. This smart farming system will reduce the problem of watering system in time. Mainly, we have introduced here with the smart farming device. The main working principle is - this device will measure the moisture of the soil and give the report whether soil is dry or soggy. Then basing on this information this device will work. When the water is dry, the device will give command to the water pump to activate and start watering. While the soil becomes soggy, the water pump will be switched off automatically. In this way, this smart farming device will work.

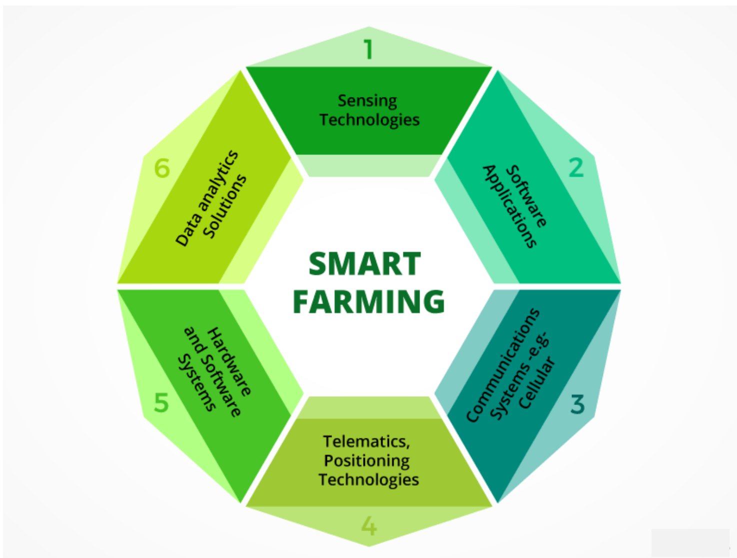
Keywords: Smart farming, measure soil moisture, watering the field, Arduino UNO, soil moisture sensor, temperature sensor, potentiometer.

Introduction:

Smart Farming is an emerging concept that refers to managing farms using modern Information and Communication Technologies to increase the quantity and quality of products while optimizing the human labor required. Among the technologies like – sensors, softwares, robotics, connectivity etc. are available for present-day farmers. [1]

The word “smart farming device” represents a device, which reduces human efforts while farming. These devices reduces human involvement on work. These saves times and money. In commercial farming, smart farming systems can make a better output. The number of workers can be reduced by using these kind of devices.

In this project, we have designed a smart irrigation system. In this device, there is a soil moisture sensor, which can measure the moisture level of soil. Whenever, the soil becomes dry the system can switch on the water pump automatically. Again, when the water becomes soggy, the system can switch off the pump. Here we need no human involvement to control this system. In farming, different plants need different moisture level of the soil. By using this device, we can easily control the moisture level for different plants.



Objective:

The objective of this project to build a smart farming device, which will measure the soil moisture and turn on/off the water pump. It also shows the condition of the soil as it is dry or soggy. This way it will take care of the soil and plants.

Now a day, we can see nursery or field which are enough big for cultivate like hybrid organic products /farming but tough to maintain the irrigation system. If we can establish the smart farming device that will be so helpful to maintain the whole irrigation system of an agricultural farm.

Components:

1. Arduino UNO
2. Soil Moisture Sensor
3. Temperature Sensor
4. Electric Motor
5. LCD Display
6. Potentiometer
7. Relay
8. Button Switch
9. Capacitors, Inductor, Resistors
10. LED (blue)
11. Battery – 12V
12. DC Power Source
13. Sounder
14. BJT

Circuit Diagram

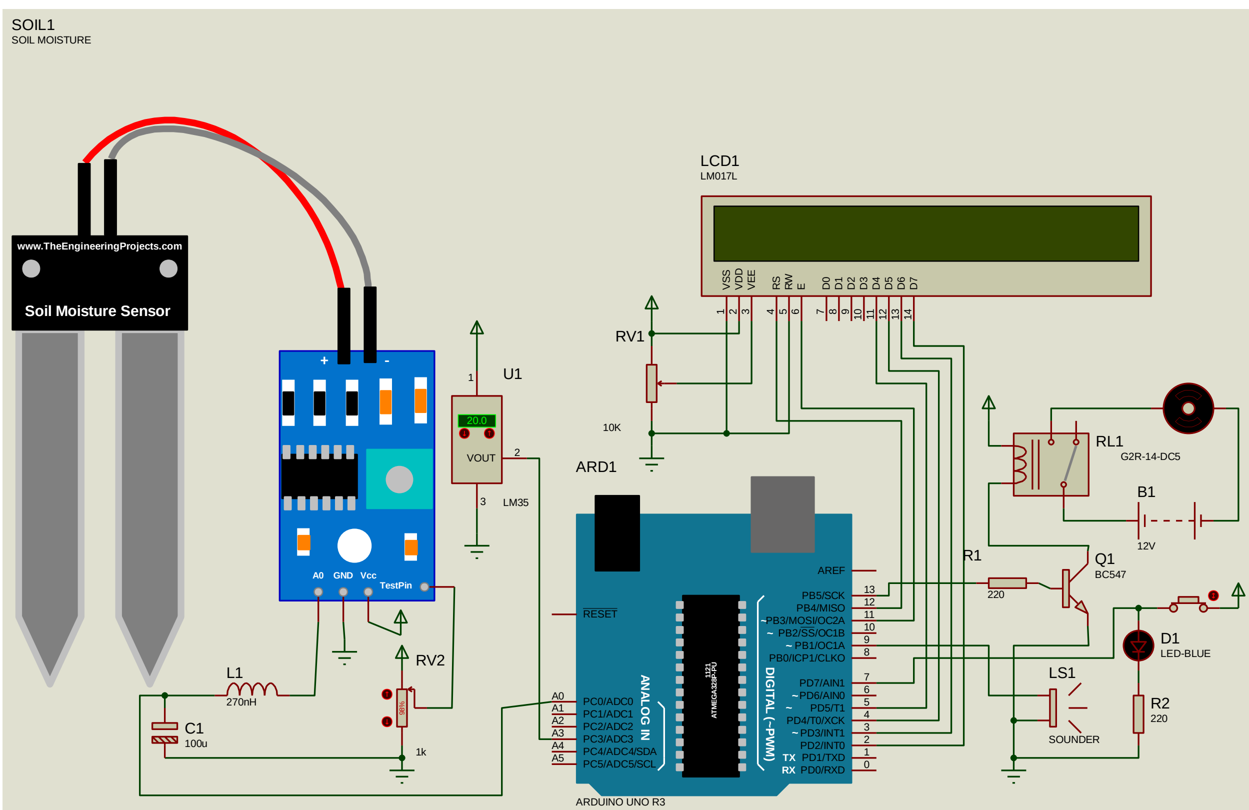


Figure -01: Circuit Diagram

Circuit Connection:

1. The soil moisture sensor has four pins, which are A0, Vcc, GND, TestPin. The Testpin is connected to the 1k potentiometer (RV2). The GND pin ic connected to the ground and Vcc is to the DC voltage source. The A0 pin of the soil moisture sensor and the A0 pic of the Arduino is connected each other. An inductor (L1) is connected in series between these pins. Again, a capacitor (C1) is connected to the A0 pin of the Arduino and ground.
2. There is a temperature sensor (LM35), which has three pins. The VOUT pin is connected to the A3 pin of the Arduino. Other two pins are connected to the DC voltage source and ground.
3. A sounder is connected with the pin no. 9 of the Arduino and with the ground.
4. A blue LED light has been connected with the pin no. 7 of the Arduino. It is also connected with the DC voltage source. A button switch has been inserted with the voltage source and the LED in series. This switch is controlled according to the Arduino signal. While connecting the LED and ground, a 220-Ohm's resistor (R2) has been connected in series.
5. An n-p-n transistor is used there. The base of the transistor is connected to the pin no. 13 of the Arduino. A resistor of 220-Ohm's is connected in series between the transistor and the Arduino. The emitter of the transistor is connected to the ground. The collector of the transistor is connected to the control ground pin of the relay.
6. There is a single pole double through relay switch. Its control ground pic is connected to the transistor and the control signal pin is connected to the DC voltage source. Here, a DC motor and 12-V battery is connected in series. The battery is connected to the voltage in (pole) terminal of the relay. On the other hand, the motor is connected to the voltage out (through) terminal of the relay.

7. A LCD display has been used in this circuit to show the signals particularly. A potentiometer of 10k is also used. One pole of the potentiometer is connected to the DC voltage source and the VDD pin of the LCD display and the another pole in connected to the ground. The contrast control (VEE) pin of the LCD display is connected to the potentiometer. The ground pin (VSS) is connected to the ground.
8. The resister signal (RS) pin is connected to the pin no. 12 of the Arduino. Again, the enable (E) pin of the display is connected to the pin no. 11 of the Arduino. The read/write (RW) pin is directly connected to the ground. The data pin 4, 5, 6 and 7 of the LCD display is connected to the pin no. 5, 4, 3 and 2 of the Arduino respectively. This is the overall connection of the components of this device.

Arduino Code:

```
//Smart Irrigation System

#include <LiquidCrystal.h> //LCD Library

#define NOTE_C4 262
#define NOTE_D4 294
#define NOTE_E4 330
#define NOTE_F4 349
#define NOTE_G4 392
#define NOTE_A4 440
#define NOTE_B4 494
#define NOTE_C5 523

int temp;
int T_Sensor = A3;
int M_Sensor = A0;
int W_led = 7;
int P_led = 13;
int Speaker = 9;
int val;
int cel;


LiquidCrystal lcd(12, 11, 5, 4, 3, 2);

void setup()
 {
    lcd.begin(16, 2);
    lcd.clear();
    pinMode(13,OUTPUT);
    pinMode(7,INPUT);
    pinMode(9,OUTPUT);

    val = analogRead(T_Sensor); //Read Temperature sensor value
    int mv = ( val/1024.0)*5000;
    cel = mv/10;

}


void loop()
{

  lcd.clear();
  int Moisture = analogRead(M_Sensor); //Read Moisture Sensor Value

  lcd.setCursor(0,0);
  lcd.print("TEMP:");
  lcd.setCursor(5,0);
  lcd.print(cel);
  lcd.setCursor(7,0);
  lcd.print("*C");

 if (Moisture> 700)   // for dry soil
  {
       lcd.setCursor(11,0);
       lcd.print("DRY");
       lcd.setCursor(11,1);
       lcd.print("SOIL");
if (digitalRead(W_led)==1) //test the availability of water in storage
{
  digitalWrite(13, HIGH);
  lcd.setCursor(0,1);
  lcd.print("PUMP:ON");
}
else
{
  digitalWrite(13, LOW);
  lcd.setCursor(0,1);
  lcd.print("PUMP:OFF");

    tone(Speaker, NOTE_C4, 500);
    delay(500);
    tone(Speaker, NOTE_D4, 500);
    delay(500);
    tone(Speaker, NOTE_E4, 500);
    delay(500);
    tone(Speaker, NOTE_F4, 500);
    delay(500);
    tone(Speaker, NOTE_G4, 500);
    delay(500);
          }
      }

     if (Moisture>= 300 && Moisture<=700) //for Moist Soil
    {
      lcd.setCursor(11,0);
     lcd.print("MOIST");
     lcd.setCursor(11,1);
     lcd.print("SOIL");
     digitalWrite(13,LOW);
     lcd.setCursor(0,1);
     lcd.print("PUMP:OFF");
   }


    if (Moisture < 300)  // For Soggy soil
    {
      lcd.setCursor(11,0);
       lcd.print("SOGGY");
       lcd.setCursor(11,1);
       lcd.print("SOIL");
       digitalWrite(13,LOW);
       lcd.setCursor(0,1);
       lcd.print("PUMP:OFF");
    }
  delay(1000);
 }
```

Simulation

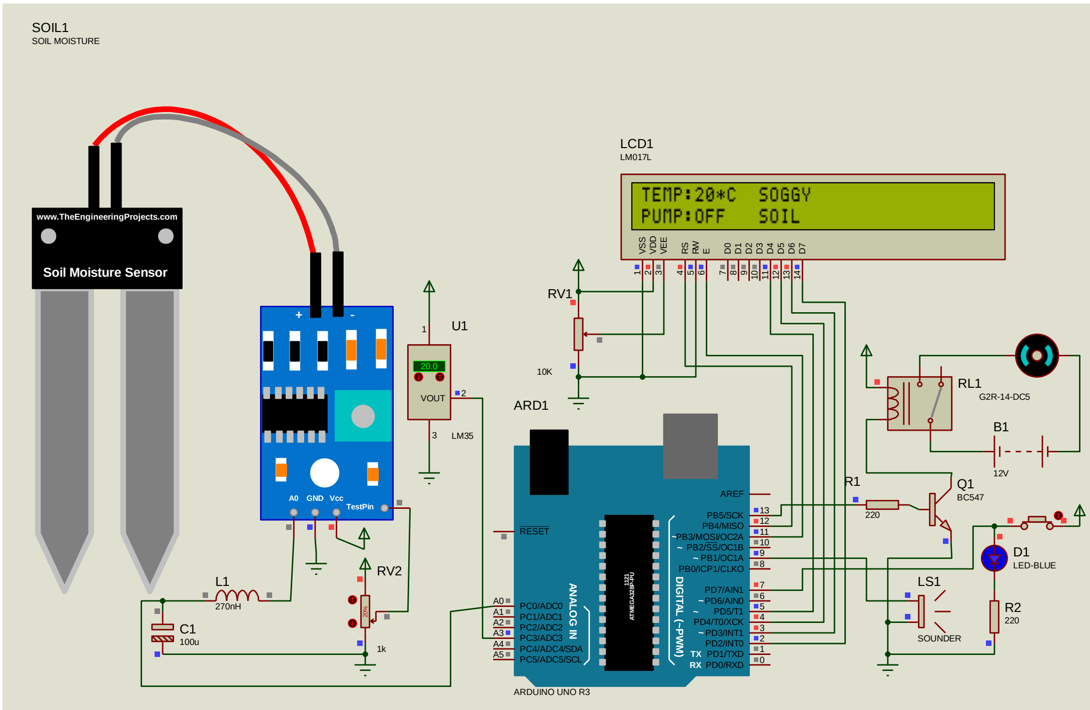


Figure -02: Simulating the Circuit when Soil is Soggy

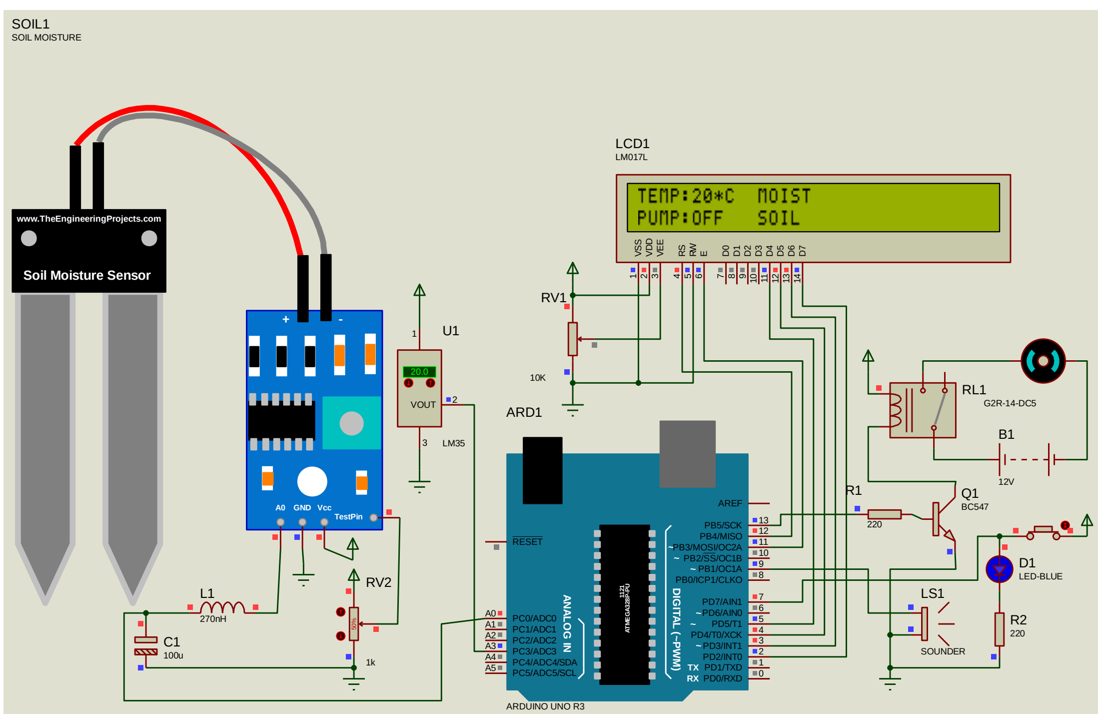


Figure -03: Simulating the Circuit when Soil is Moist

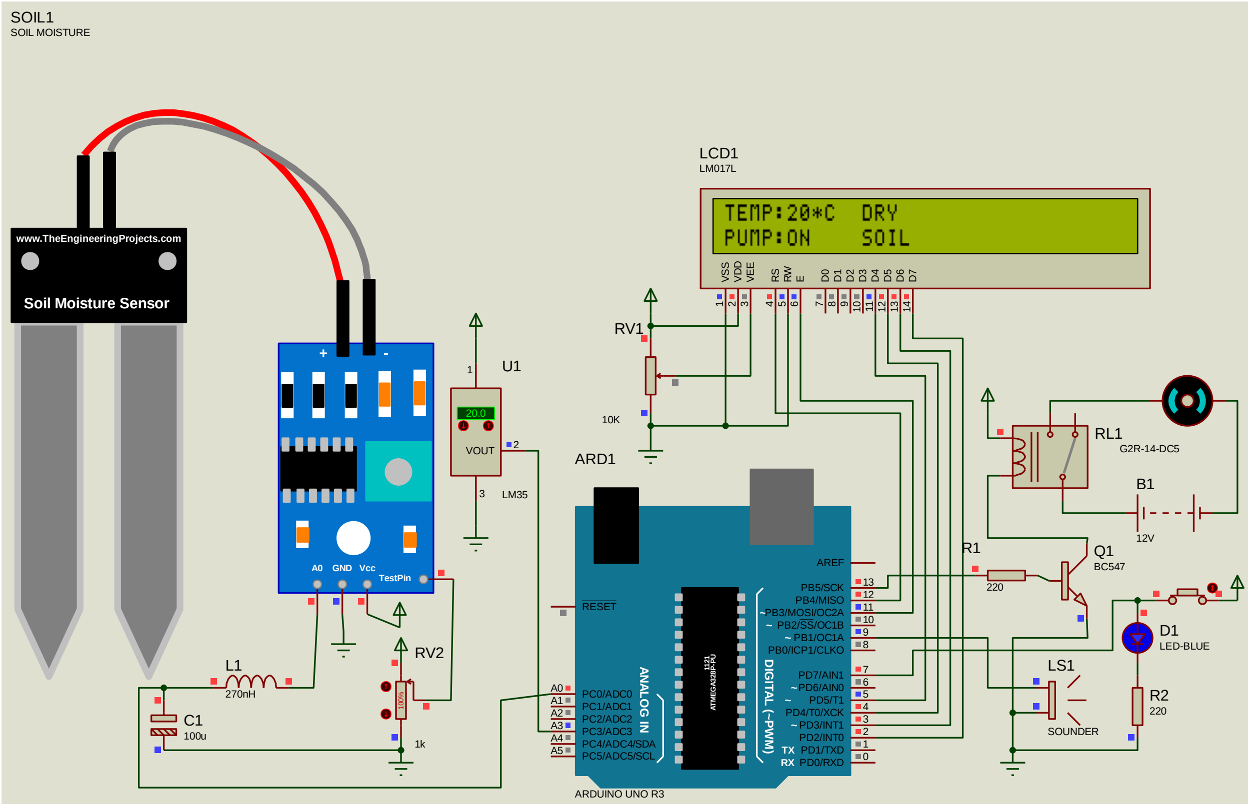


Figure -04: Simulating the Circuit when Soil is Dry

Working Method:

1. The soil moisture sensor and the temperature sensor is connected to the Arduino UNO. The soil moisture sensor measures the moisture of the soil and the temperature sensor measures the temperature of the soil. These two devices send signals to the Arduino.
2. We have a water pump and it is connected to the 12-V battery and a relay. The relay works according to the signal of the Arduino. The relay gets switch on/off as per Arduino signals.
3. The LCD display also works according to the signals of the Arduino. The display shows the temperature, moisture condition of the soil and the status of the water pump that it is on/off.

4. The button switch is the main switch of this device. By controlling this switch, we can activate/deactivate the watering system. When the switch is on, the device will work perfectly. However, when the switch is off, the pump cannot be switched on even when the soil is dry. In that case, the Arduino will send signal to the sounder and it will make sound. It means that the system requires human approval to switch on the water pump and start watering. The blue LED indicates if the system is activated or deactivated.

5. We have kept the temperature constant for this simulation and it is 20^{o} C. The value of the POT (RV2) changes according to the moisture level of the soil. When the moisture level is high, the value of the potentiometer becomes low. It sends signal to the Arduino that the soil is soggy and keep the water pump off. On the other hand, when the moisture level of the soil is low, the value of the potentiometer becomes high and it means that the soil is dry. Therefore, the system try to switch on the water pump and start watering. Again, when the soil is moist, the value of the potentiometer is medium and there is no need to switch on the water pump. The working procedure can be shown in the following chart,

Soil Condition	Value of the POT (Ohm's)	Condition of the Water Pump
Soggy	Less than 300	Switch off
Moist	Greater than or equal to 300 & Less than or equal to 700	Switch off
Dry	Greater than 700	Switch on

In this project, we have no option to test different types of soil condition. Therefore, to simulate the system we have changed the value of the potentiometer manually.

The Effectiveness of the Device in Real Life:

- **Advantage :**

  i. Saves time

  ii. Reduces working load

  iii. Decreases the number of workers

  iv. Reduces the wastage of water

  v. Keeps the moisture of the soil in a perfect level

  vi. Increases the productivity

- **Disadvantage :**

  i. Hard to maintain

  ii. Expensive device

  iii. Harder to gain proper knowledge about using smart device

  iv. Hard to keep all devices up to date

Cost Estimation to Build this Device:

Prices of different equipment in the marketplace of Bangladesh:

1. Arduino – 800 BDT
2. LCD Display – 170 BDT [3]
3. Soil Moisture Sensor – 100 BDT [2]
4. POT-1k – 25 BDT [4]
5. POT -10k – 20 BDT [5]
6. 12-V DC Electric Motor – 790 BDT [6]
7. Temperature Sensor – 300 BDT [7]
8. 12-V Battery – 50 BDT [8]
9. 12-V Relay – 40 BDT [9]
10. Sunder – 15 BDT [10]
11. Button Switch – 17 BDT [11]
12. LED Blue – 2 BDT
13. 220-Ohm’s Resistor (10 pcs) – 15 BDT

Conclusion:

1. This project gives the overall concept about smart farming and its working process.
2. Another thing is it also gives us the online-based simulation idea, which helps us to enrich our knowledge.
3. In this project, we have built a smart device that measures the soil moisture and temperature. It can analyze the condition of the soil and turn on/off the process of watering the soil.
4. We have used a 1k potentiometer to indicate the moisture level of the soil. We controlled the POT manually while simulating. The soggy soil make the value of the POT lower. On the other hand, the dry soil make the value of the POT higher.
5. In the whole project, we kept the temperature in a constant and it is 20^{o} C.
6. This device needs no human involvement for working.
7. We can control the on/off system of the water pump by a button switch. When the switch is on, the system is free to execute. However, when the switch is off and the soil is dry, the system will try to notify the user to start watering.
8. By using this device, the user can control the overall irrigation system of an agricultural farm.

From this project, we gain these overall concepts.

References

1. https://www.iotforall.com/smart-farming-future-of-agriculture
2. https://store.roboticsbd.com/84-soil-waterph
3. https://www.daraz.com.bd/arduino/?_mkt_tracker=g&_mkt_campaign=11322136206&_mkt_adgroup=113762568369&_mkt_creative=514821604461&_mkt_src=gg&isdl=y&aff_short_key=_7agwc&gclid=Cj0KCQjw1dGJBhD4ARIsANb6OdlSJHmxtCmpY4ciYp7LjNALdxSwfUwmP5AO7xoqKdFgmYMdIVpXMc0aAr8tEALw_wcB
4. https://www.eeeshopbd.com/product/1k-ohm-potentiometer-variable-resistor-volume/
5. https://store.roboticsbd.com/components/996-10k-ohm-potentiometer-robotics-bangladesh.html
6. https://www.daraz.com.bd/products/d775-motor-dc-12v-36v-13000-19000-rpm-high-torque-high-power-motor-i2489547.html
7. https://store.roboticsbd.com/sensors/147-hr202-humidity-sensor-bangladesh.html
8. https://www.daraz.com.bd/products/sunlite-battery-um1-r20-15v-d-size-1pcs-or-2pcs-i180753101-s1122028132.html?spm=a2a0e.searchlist.list.7.7bd71282qjULoI&search=1
9. https://www.daraz.com.bd/products/2psc-12-volt-relay-i151622122-s1078838535.html?spm=a2a0e.searchlist.list.1.2beb1135pt9GpZ&search=1
10. https://www.daraz.com.bd/products/5psc-buzzer-alarm-5v-to-12v-sounder-speaker-buzzer-i150490310-s1077082596.html?spm=a2a0e.searchlist.list.1.12757c1a3Algn1&search=1
11. https://www.daraz.com.bd/catalog/?q=push+switch&_keyori=ss&from=input&spm=a2a0e.searchlist.search.go.2b3d268c1QZAZp
12. https://www.youtube.com/watch?v=pcawhua_tdE
13. https://www.youtube.com/watch?v=0c_bkJBfUak
14. https://www.youtube.com/watch?v=7bTBUeo63AY

THE END