CSE 360

Lab Project Proposal Submission

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Group No: 08

Project Name: Smart irrigation system

Group members:

Ehsan Abdullah Khan Saad (20101512)

Tashdid Al Shafi Turjo (20101311)

Mohammad Arafat (20101281)

Ishran Akbar (20101036)

Munem Shahriar Khan (20301321)

Submitted to:

Shakir Rouf (SKR)

Mehedi Hasan Emo

Department of Computer Science and Engineering

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Introduction

A very important component of the agricultural system is irrigation. The hardest part of irrigation is figuring out when to deliver the water because it is difficult to predict when the plants need it and when to stop the supply. As a result, crops can suffer from over or under water supply. So, we intend to automate the irrigation system so that we can determine precisely when the plants require water, start the supply, and stop it once there is enough water for the plants.

Application Area

The extensive capabilities of our system will have a great impact on society as well as the economy. As the economy of Bangladesh is mainly dependent on agriculture, the economy will be greatly enriched as crop losses will be reduced with this project. There are hardly any side effects from this project. It is surprising that from the convenience of a few simple sensors, the supply of water to the whole field and the refill of the tank can be done automatically. This makes it possible for users to rest assured that no excessive or less water is being supplied to the field as it can harm the crops. As a result, the production of good crops has increased. Thus, it could be a great solution to reduce the number of wasted crops due to over or under water supply.

Technologies and Tools

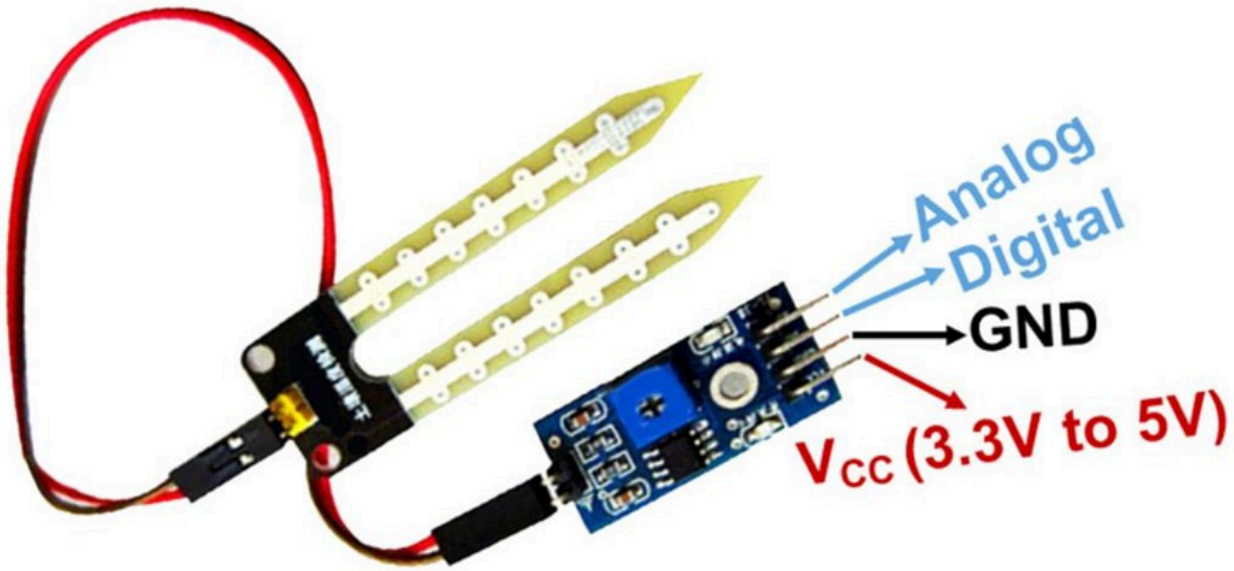
1. Moisture Sensor
2. Ultrasonic Sensor
3. Microcontroller (Arduino Uno R3)
4. BJTs
5. Diodes
6. Relays
7. Voltage sources
8. Display
9. Motors

Programming Language

The programming LANGUAGE that would be used in this project would be C++.Because we know c++ runs well in arduino and it is an open source language to make the arduino operational.

Working Mechanisms of Sensors

Moisture sensor:



The soil moisture sensor is one kind of sensor used to gauge the volumetric content of water within the soil. As the straight gravimetric dimension of soil moisture needs eliminating, drying, as well as sample weighting. These sensors measure the volumetric water content not directly with the help of some other rules of soil like dielectric constant, electrical resistance, otherwise interaction with neutrons, and replacement of the moisture content.

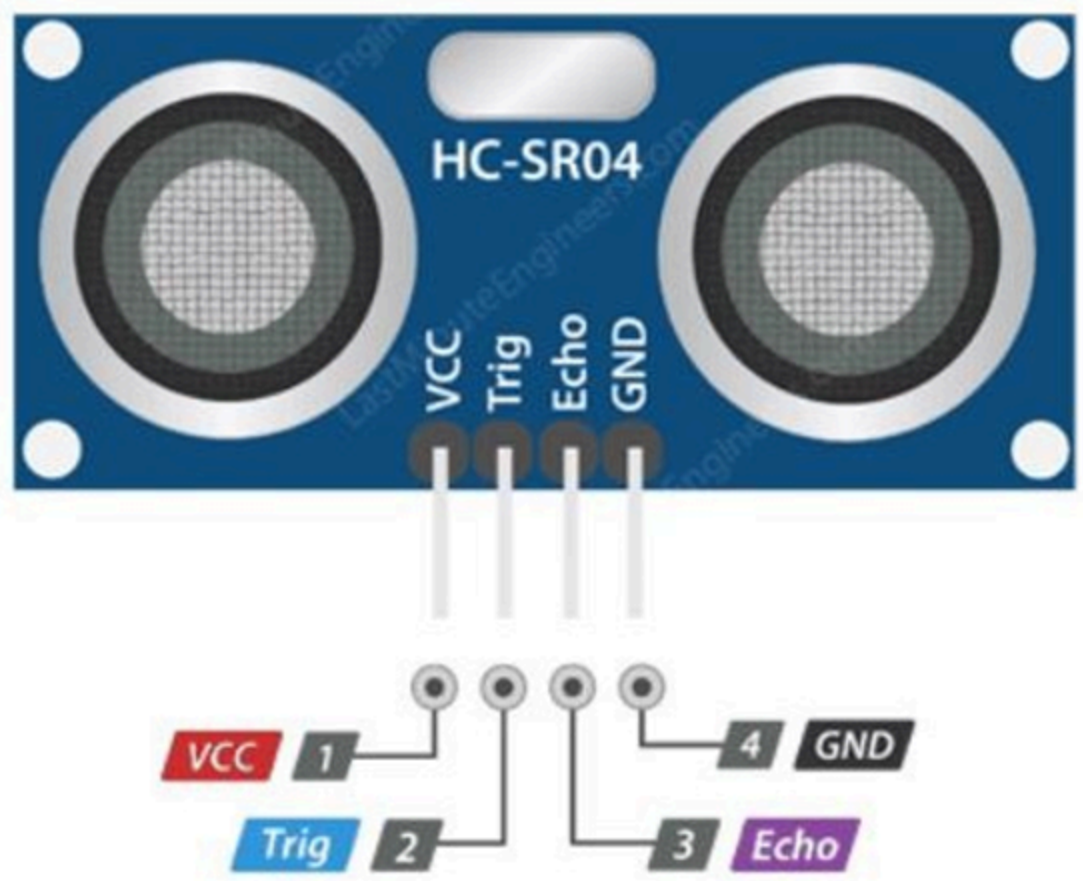
It has four pins:

- VCC pin is used for power
- A0 pin is an analog output
- D0 pin is a digital output
- GND pin is a Ground

This sensor mainly utilizes capacitance to gauge the water content of the soil (dielectric permittivity). The working of this sensor can be done by inserting this sensor into the earth and the status of the water content in the soil can be reported in the form of a percent.

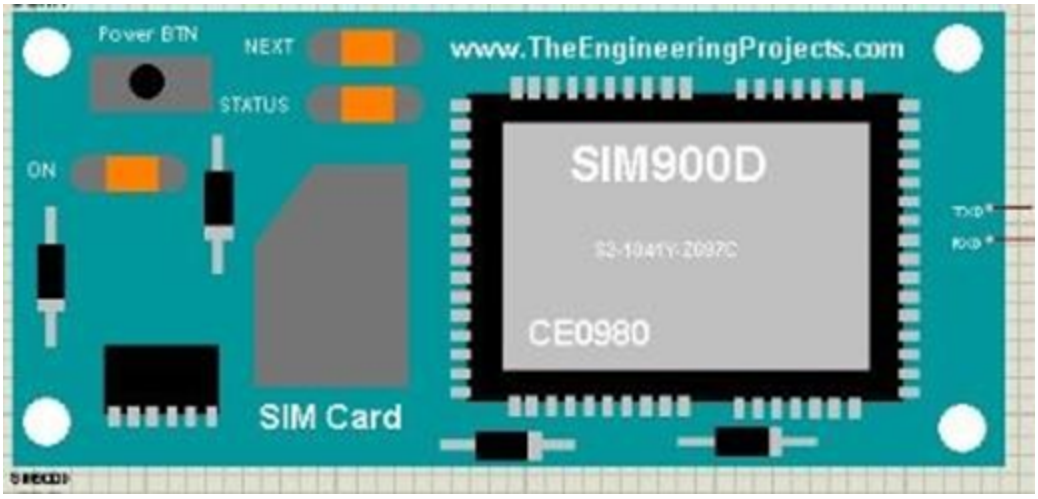
This sensor makes it perfect to execute experiments within science courses like environmental science, agricultural science, biology, soil science, botany, and horticulture.

Ultrasonic sensor:



An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound. Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has traveled to and from the target).

Sim 900D GSM module:



The SIM900D is a complete Quad-band GSM/GPRS solution in a SMT module which can be embedded in the customer applications. Featuring an industry-standard interface, the SIM900D delivers GSM/GPRS 850/900/1800/1900MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption.

The SIM900 GSM uses UART protocol to communicate with an Arduino. The chip supports baud rate from 1200bps to 115200 bps with Auto-Baud detection. With the help of jumpers, you can connect (RX, TX) of the shield to either Software Serial (D8, D7) or Hardware Serial (D1, D0) of the Arduino.

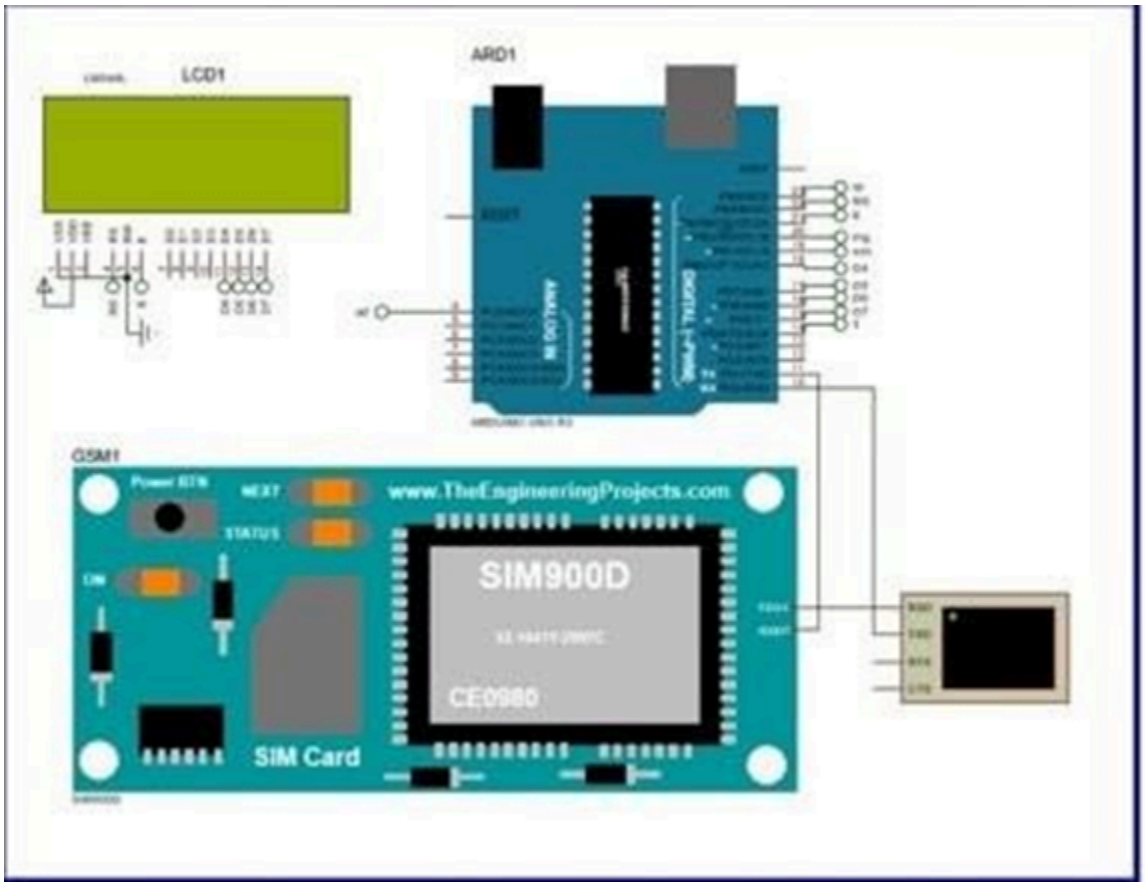
Display: Here we used an LCD display to show the sensor data taken from soil and the water tank and whether the motors are on or off.

Arduino Uno: Also, Arduino uno plays a vital role in this system as it is the controller. In the code we fixed the range of the irrigation motor as well as the water pump. For the irrigation pump if the moisture level of the field is less than 85% then the motor will start automatically and release the water in the field and it will turn off when the level is more than 85%. At the same time if the water level of the tank is less than 65% then the water tank pump will start automatically and fill the tank and it will automatically turn off when the level is more than 65%.

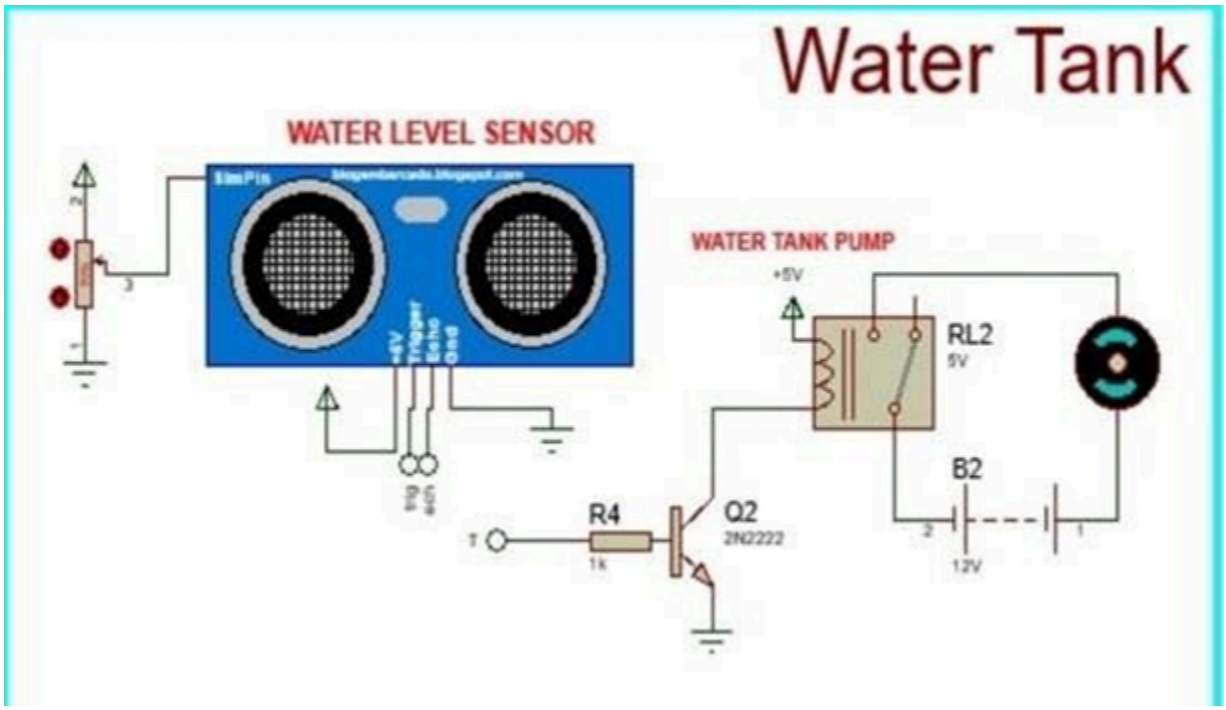
GSM Module: Here the GSM module (sim900D) is used to send a text to the owner and inform about the conditions. As a result, he can always check even if he is away.

Connection With Ics

Circuit Board

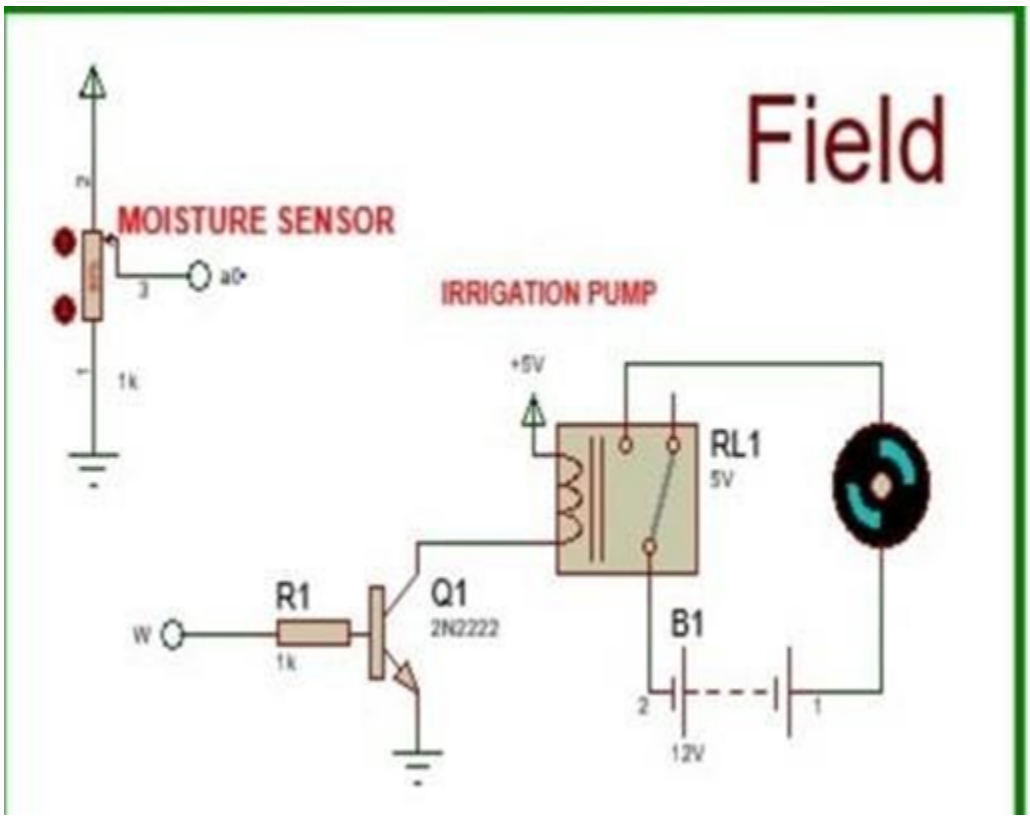


Water Tank:



In this section we used an ultrasonic sensor to determine the water level. From the mother circuit board, Arduino gives command according to the sensor data (whether it is more or less than 65%). And this will trigger the relay which makes the motor start and supply the water to the tank and vice versa.

Field Setup:



Here we used a moisture sensor to sense the moisture level in the field and release the water according to the command of Arduino. In this circuit if the moisture level is less than 85% then it will trigger the relay and the irrigation pump supplying the water in the field and vice versa.

Data flow from sensors through ICs to I/O devices

The Moisture and ultrasonic sensors send signals about the moisture level of the soil and water level of the tank to the Arduino microcontroller.

1. An Arduino microcontroller receives the signals sent from the sensors. Arduino Microcontroller issues commands to the appliances based on the received signal.
2. All the commands are given to the Arduino microcontroller via codes.
3. According to the water and moisture levels, the microcontroller sends a signal to the relay.

4. After relay gets the signal, it completes or disconnects the tank pump and the irrigation pump.

That's how the irrigation system will run automatically.

Arduino Code

```
#include<LiquidCryst.
h>

#include<SoftwareSeri
al.h>

#include <Wire.h>


#define echo 9

#define trigger 10
#define tank_pump 4
#define
watering_pump 13
#define
moisture_sensor A0
long duration; int
distance; int
moisture_value; int
distance_percent;
int moist_percent;


SoftwareSerial SIM900(2,
3); LiquidCrystal
lcd(12,11,8,7,6,5);


void setup () {
lcd.begin(20,4);
SIM900.begin(9600);
Serial.begin(9600);
pinMode(echo,INPUT);
pinMode(moisture_sensor,INPU
T); pinMode(trigger,OUTPUT);
digitalWrite(trigger,LOW);
```

```
pinMode(watering_pump,OUTP
UT);
pinMode(tank_pump,OUTPUT);
digitalWrite(watering_pump,LO
W);
digitalWrite(tank_pump,LOW);


lcd.setCursor(0,1);
lcd.print(" SMART
IRRIGATION ");
lcd.setCursor(0,2); lcd.print("
================ "); delay(500);
lcd.clear();
}


void loop(){

 //WATER LEVEL SENSOR
 digitalWrite(trigger,L
OW);
delayMicroseconds(2)
;
digitalWrite(trigger,H
IGH);
delayMicroseconds(1
0);

digitalWrite(trigger,LOW);
duration=pulseIn(echo,HIGH);
distance=duration*0.017; distance_percent=map(
distance,0,1023,0,100); moisture_value=
analogRead(moisture_sensor);
moist_percent=map(moisture_value,0,1023,0,100);
condition();


}



void sms(){
SIM900.print("AT+CMGF=1\r")
;
SIM900.println("AT + CMGS = \"+233266302607\"");// recipient's mobile number
```

```
SIM900.println("IRRIGATION PUMP IS OFF"); // your message that needs to be sent
Serial.println("IRRIGATION PUMP IS OFF");


SIM900.println((char)26); // End AT command with a Upper Case Z, which is ASCII code 26
Serial.println((char)26);
SIM900.println();
}



void sms1(){
SIM900.print("AT+CMGF=1\r")
;

SIM900.println("AT + CMGS = \"+233266302607\"");// recipient's mobile number



SIM900.println("WATER TANK PUMP IS OFF"); // your message that needs to be sent
Serial.println("WATER TANK PUMP IS OFF");



SIM900.println((char)26); // End AT command with a Upper Case Z, which is ASCII code 26
Serial.println((char)26);
SIM900.println();
}



void sms2(){
SIM900.print("AT+CMGF=1\r")
;

SIM900.println("AT + CMGS = \"+233266302607\"");// recipient's mobile number



SIM900.println("IRRIGATION PUMP IS ON"); // your message that needs to be sent
Serial.println("IRRIGATION PUMP IS ON");
SIM900.println((char)26); // End AT command with a Upper Case Z, which is ASCII code 26
Serial.println((char)26);
SIM900.println();
}
```

```
void sms3(){
SIM900.print("AT+CMGF=1\r")
;

delay(1000);

SIM900.println("AT + CMGS = \"+233266302607\"");// recipient's mobile number


SIM900.println("WATER TANK PUMP IS ON");

Serial.println("WATER TANK PUMP IS ON");
SIM900.println((char)26); // End AT command with a Upper Case Z, which is ASCII code 26
Serial.println((char)26);
SIM900.println();
}


void condition(){ if
(distance_percent>65
&&moist_percent<85){ LCD_3();
digitalWrite(tank_pump,LOW);
digitalWrite(watering_pump,HIGH);
sms1();
sms
2();
dela
y(30
0);

}

else if (distance_percent<65 &&moist_percent>85)
{
LCD_2();
digitalWrite(tank_pump,HIGH);
digitalWrite(watering_pump,LOW);
sms(); sms3();

delay(300);

}
else if (distance_percent>65 &&moist_percent>85)
{
```

```
LCD_4();
digitalWrite(tank_pump,LOW);
digitalWrite(watering_pump,LOW);
sms(); sms1();

delay(300);

}


else if (distance_percent<65 &&moist_percent<85)

{
LCD_1();
digitalWrite(tank_pump,HIGH);
digitalWrite(watering_pump,HIGH);
sms3();
sms2();
delay(300); }


}


  void LCD_1()

  {
  lcd.clear();
    lcd.setCur
    sor(0,0);
  lcd.print("WATER TANK LEVEL=");
  lcd.print(distance_percent)
; lcd.print("%");
lcd.setCursor(0,1);
lcd.print("SOIL
MOISTURE= ");
lcd.print(moist_percen
t); lcd.print("%");
lcd.setCursor(0,2);

lcd.print("IRRIGATION   PUMP");

  lcd.print("
    ON");
    lcd.setCur
    sor(0,3);
  lcd.print("WATER TANK PUMP");
  lcd.print(" ON");
```

```
  }


  void
    LCD_2(){
    lcd.clear();
    lcd.setCur
    sor(0,0);
  lcd.print("WATER TANK LEVEL=");
  lcd.print(distance_percent)
; lcd.print("%");
lcd.setCursor(0,1);
lcd.print("SOIL
MOISTURE= ");
lcd.print(moist_percen
t); lcd.print("%");
lcd.setCursor(0,2);

lcd.print("IRRIGATION   PUMP");

lcd.print("                          OFF");

  lcd.setCursor(0,3);
    lcd.print("WATER TANK
    PUMP");
  lcd.print(" ON");
  }
  void
  LCD_3(){
  lcd.clear();
  lcd.setCurs
  or(0,0);
   lcd.print("WATER TANK LEVEL=");
lcd.print(distance_percent); lcd.print("%");


  lcd.setCursor(0,1);
lcd.print("SOIL
MOISTURE= ");
lcd.print(moist_percen
t); lcd.print("%");
   lcd.setCursor(0,2);
lcd.print("IRRIGATION
          PUMP");
  lcd.print("
    ON");
    lcd.setCur
    sor(0,3);
  lcd.print("WATER TANK PUMP");
```

```
  lcd.print(" OFF");
  }



  void
  LCD_4(){
  lcd.clear();
  lcd.setCurs
  or(0,0);
   lcd.print("WATER TANK LEVEL=");
  lcd.print(distance_percent); lcd.print("%");
    lcd.setCursor(0,1);

lcd.print("SOIL MOISTURE= ");

lcd.print(moist_percen
t); lcd.print("%");
   lcd.setCursor(0,2);
lcd.print("IRRIGATION
          PUMP");

lcd.print("                              OFF");

  lcd.setCursor(0,3);
    lcd.print("WATER TANK
    PUMP");
  lcd.print(" OFF");
  }
```

Cost Analysis:

Components	Amount	Price	Total
Moisture sensor	1	99 taka	99 taka
Ultrasonic Sensor	1	95 taka	95 taka
5V source	1	70 taka	70 taka
Arduino	1	1050 taka	1050 taka
BJT(npn)	2	5 taka	10 taka
Relay	2	75 taka	150 taka
Motor Pump	2	150 taka	300 taka
Display	1	600 taka	600 taka
Sim900D	1	1100 taka	1100 taka
			3,474 taka (Approximate)

Responsibilities of each member:

Ehsan:

1.Idea
2.Planning
3.Hardware connection.
4.Report Writing.

Turjo:

1. Report writing.
2. Planning
3. Hardware connection.

Munem:

1. Cost Analysis
2. Hardware collection
3. Report Writing

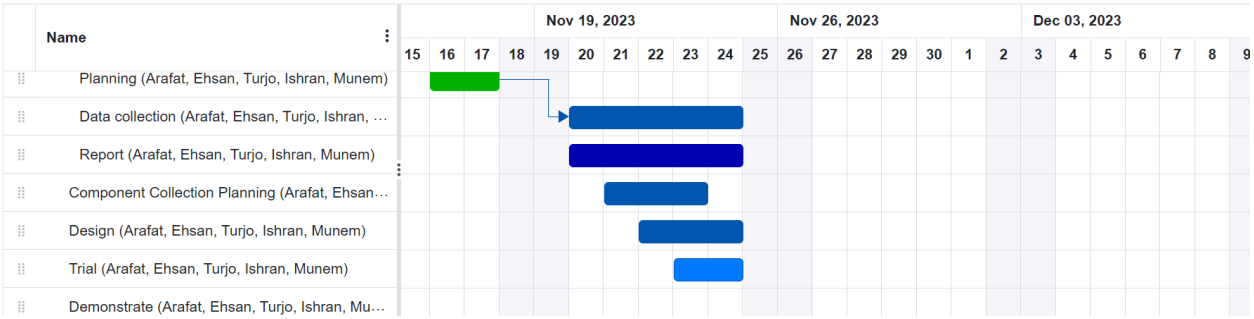
Arafat:

1. Hardware implementation.
2. Software(codes).

Ishran:

1. Report writing.
2. Hardware collection
3. Code implementation.

Workplan (Gantt Chart):



Conclusion:

The extensive capabilities of this system are what make it so interesting. From the convenience of a few simple sensors, the supply of water to the whole field and the refill of the tank can be done automatically. This makes it possible for users to rest assured that no excessive or less water is being supplied to the field as it can harm the crops. As a result, the production of good crops has increased. Thus, it could be a great solution to reduce the number of wasted crops due to over or under water supply.

Reference:

1. Technologies, M. (2023, July 29). *Soil moisture detector mini project using 8051 microcontroller*. Microtronics Technologies. https://www.projectsof8051.com/soil-moisture-detector-mini-project/