Microcontroller Based Plant Hydrator Using Weather Prediction and Soil Analysis

Md. Tanvir Hossain Joarddar
2018-1-60-242
Department of CSE
East West University

Shaolin Zahan Aume
2018-1-60-153
Department of CSE
East West University

Sharmin Sharkar Rima
2018-1-60-176
Department of CSE
East West University

***Abstract* - Microcontroller based plant hydrator using weather prediction and soil analysis is an Arduino based project which can be used to water the plant based on some characteristics of the environment around the plant. The system can sense whether the soil is wet or not. It will consider the temperature or soil moisture. After measuring these properties, the system will predict whether water is needed for the plants. Then it will supply the desired amount of water.**

***Keywords* - Arduino, soil moisture, temperature sensor, relay, sounder, motor, 20x4 LCD**

I. INTRODUCTION

Watering the plants is labor intensive work. It is very important to control the amount of water that reaches the plants whatever the weather it is. Ground water level is declining day by day due to unplanned use of water. So water shortage is also a problem nowadays. Sometimes farmers turn on the motor and then forget to switch it off due to negligence of work, which causes water wastage. It also happens that sometimes they forget to give water which causes damage to crops. So proper use of water is very important. Our project can overcome this problem. This project is based on an Arduino microcontroller. A soil moisture sensor is used to sense the moisture level of the soil. Then it will send a signal based on it. Relay is like a switch. It is used to handle the distribution of larger power based on low power signals. Temperature sensor is used to measure the temperature of the environment. We have included more proper instruments to create a system that can measure soil moisture and temperature using Arduino. The aim of our project is to develop a plant hydrator system which measures the moisture of the soil and temperature. Then it automatically turns on or off the water supply system.

II. RELATED WORKS

From some previous works, they developed their system by incorporating some sensing devices which sense the dry condition of the defined field or farmland and pass the state to the automation system, A Control algorithm for water flow regulation. The deficiencies in this irrigation system was: The system lacked the ability to detect the temperature of the weather. We have extended something new in our project. We have tried to use more technology so that the acceptance of our project will be high. We have used a temperature sensor, which measures the temperature along with the measurement of moisture.

III. METHODOLOGY

Microcontroller based plant hydrator using weather prediction and soil analysis system using Arduino microcontroller UNO R3 is programmed such that it gives the interrupt signals to the motor via the motor driver module. A0 pin of the Arduino board is connected to the Soil sensor which senses the moisture content present in the soil. Whenever the soil moisture content value goes down, the sensor senses the moisture level change, giving a signal to the microcontroller so that the pump (motor) can be activated. This concept can be used for automatic plant watering systems. The circuit comprises an Arduino UNO board, a soil moisture sensor, a 12V motor pump, and a 12V Relay to run the water pump. A 5V to 9V wall wart or plugin adapter or solar panel needs to power the Arduino board. A separate 12V battery is required for the pump motor [1].

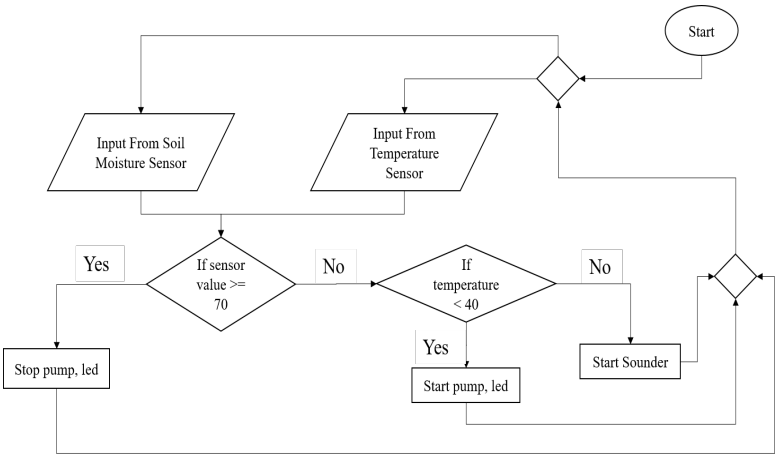


Figure 01: Flow chart of the model

IV. COMPONENTS & REQUIREMENTS

- Arduino UNO R3
- Potentiometer 10K Ohm
- COIL .27uH
- Capacitor100uF
- DC Voltage Source (battery) 12v
- NPN Transistor
- Push Button
- LED (Blue)
- Temperature Sensor
- 20x4 Alphanumeric LCD
- DC Motor
- Relay
- Analog Resistor
- Soil Moisture Sensor
- Sounder

Arduino

Arduino board is an open source platform which is used for building electronics projects. Arduino is a programmable circuit's board in which we can write a program based on the project. The Arduino program will be uploaded with IDE (Integrated Development Environment) software that runs a computer, it is used to write and upload computer code (a HEX file) to the Arduino physical board. Arduino language is merely a set of C/C++ functions that can be called from the code.

Motor 12V

A motor is used to artificially supply water for a particular task. It can be electronically controlled by interfacing it to a microcontroller. It can be triggered ON/OFF by sending signals as required. Pumping means the process of artificially supplying water. In this project a 12V DC motor is used for water pumping.

Soil Sensor

Soil Moisture Sensors measure the amount of moisture in the soil. Since the direct hydrometric measuring of free soil wetness needs removing, drying, and coefficient of a sample, soil wetness sensors live the meter water content indirectly by victimization another property of the soil, like electrical phenomenon, nonconductor constant, or interaction with neutrons, as a proxy for the

wetness content. Here, we have converted the signal value from (19 to 1019) to (1 to 100) percent.

Temperature Sensor

The LM35 temperature sensor can be used to measure temperature with an electrical output proportional to the temperature (in °C).The LM35 is an Integrated Circuit Temperature Sensor. In order to calculate the Celsius reading from the analog value, we use the following formula to calculate the temperature in Celsius [2]:

$$tempC = \frac{5.0 * 1000 * temp}{1024 * 10}$$

Where,

temp = value of the serial port.

tempC = calculated temperature value in Celsius

20x4 LCD

LCD (Liquid Crystal Display) screen is an electronic display module. It has a wide range of applications. A 20x4 LCD display is a very basic module and is very commonly used in various devices and circuits. LCDs are easily programmable and have no limitation of displaying animations, special & even custom characters (unlike in seven segments), animations and so on.

Transistor

Here we used Silicon NPN Low Power Bipolar Transistor which may be a common NPN bipolar semiconductor device or bipolar junction transistors (BJT) used for general purpose low-power amplifying or switch applications. It is designed for low to medium current, low amplifying current, low power, medium voltage, and might operate at moderately high speeds.

Relay

Relay is an electrically operated switch. Several relays use a magnet to automatically operate a switch, however alternative in operation principles are used, like solid state relays. Relays are used wherever it's necessary to regulate a circuit by a separate low-power signal, or wherever many circuits should be controlled by one signal.

Resistor

Resistor is an electrical device that may be a passive two-terminal electrical part that implements resistance as a circuit component. In electronic circuits, resistors unit of measurement accustomed reduce current flow, alter signal levels, to divide voltages, bias active components and terminate transmission lines, among completely different uses.

Coil

A coil is an electrical conductor that consists of a series of conductive wires wrapped around a ferromagnetic core. Electric coils are one of the simplest forms of electronic components and provide inductance in an electrical circuit, an electrical characteristic that opposes the flow of current.

Potentiometer

A potentiometer is also known as a pot or potmeter. It is defined as a 3 terminal variable resistor where the resistance is manually changed to control the flow of electric current. A potentiometer acts as an adjustable voltage divider.

Capacitor

The capacitor is a component which has the ability or capacity to store energy in the form of an electrical charge producing a potential difference (Static Voltage) across its plates, much like a small rechargeable battery. There are many types of capacitors available from beads of very small capacitors used in resonance circuits to large power factor correction capacitors, but they all do the same thing, they save charge.

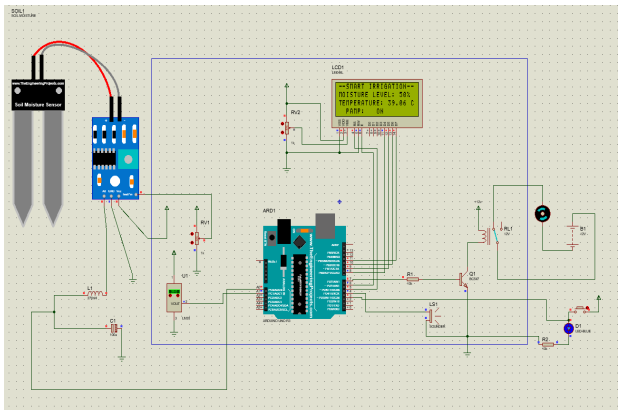
DC Voltage Source (Battery)
A DC voltage source consisting of two or more cells that convert chemical, nuclear, solar, or thermal energy into electrical energy.

Sounder
Piezoelectric sounders are sound components which generate sound suitable for use as input signals (including multi-tone, melody and so forth) without built-in oscillator circuits. It can be used in a wide range of applications. They come in SMD type, which is suitable for small, high-density mount and pin type. It can be used for general purposes.

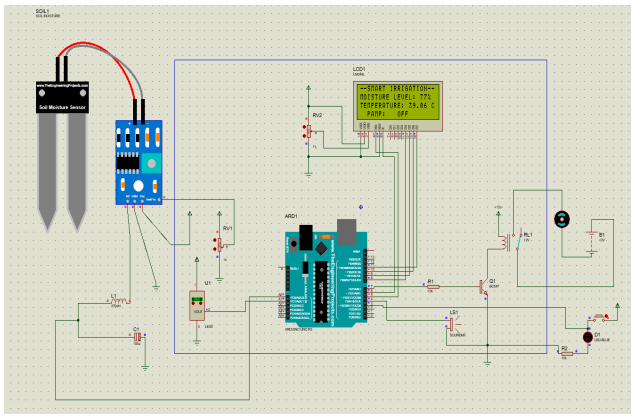
V. RESULT

After successful implementation of the circuit diagram, the following outputs will be obtained:

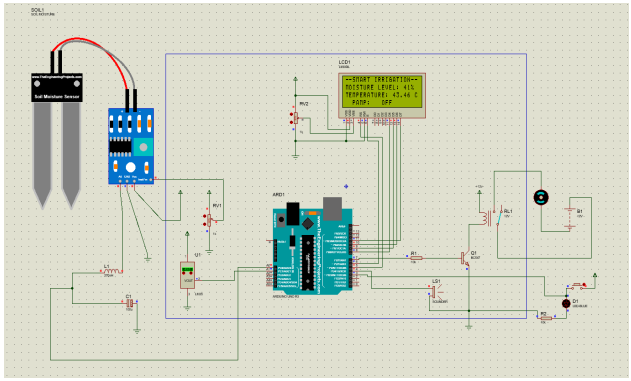
1) When the value of soil moisture is 50% and temperature is less than 40 C. This makes the relay in ON state. The microcontroller sends output 1 to the motor circuit. Hence it will result in turning ON the MOTOR and LED.



2) When the value of soil moisture is 77%. This makes the relay in OFF state. The microcontroller sends output 0 to the motor circuit. Hence it will result in turning OFF the MOTOR and LED.



3) When the value of soil moisture is 41% and temperature is greater than 40 C. Then the microcontroller sends output 1 to the sounder circuit. Hence it will result in turning ON the sounder and stop the MOTOR and LED.



VI. ADVANTAGES

Our system is relatively simple and easy to implement as the design is very simple. The wastage of water will be decreased as it doesn't execute manually so the percentage of error happening will be very less. It can also prevent water loss from evaporation. The automation of valves eliminates the manual operation of closing and opening

valves. It allows the use of automation in different processes and helps conserve water. Night operation is also possible with this system as it can regulate the irrigation process at night. The irrigation process starts and stops when required exactly. We also know that when the temperature is high we can't water the soil, so it measures the temperature as well as moisture, then decides if it will execute or not. In case of any emergency it will make sound to get notification.

VII. FUTURE WORK

There are many scopes for the further work while working with our module.

A. Incorporation of Artificial Intelligence

We know that weather and soil characteristics are not the same for all places. As a result, we have thought of implementing artificial intelligence to adapt our products to the surrounding atmosphere.

B. Time scheduling

We can add clocks to set the time. So that we can control the module when we feel that we need to water the soil. So the module automatically starts watering the soil in a fixed time and stops giving water in a fixed time.

C. Adding GSM

The meaning of GSM is Global System for Mobile communications. GSM is a network that supports both cellular and data. GSM can be added to our module so that we can control it from remote areas.

VIII. CONCLUSION

Our Project is used for the maximum use of water in agricultural fields without the intervention of humans by using a soil moisture Sensor that senses the moisture content of the Soil and measures the temperature by using a Microcontroller. By censoring the soil moisture and temperature, the motor is turned ON/OFF the pump automatically and executes the process until water is needed for the irrigation which is helpful for water saving. In the early days, an agriculturist had to physically go to their land and check the moisture of soil. It allows the agriculturist to screen and keep up the moisture remotely regardless of time. There is also a huge interest in the structure and future expansion. It permits the individuals to make use of the standard and valuable framework in their respective fields.

REFERENCES

[1] A. Tyagi and N. Gupta, "Smart Irrigation System," vol. 3, no. 10, p. 4.

[2] "Measuring Room temperature using LM35 Temperature Sensor with Arduino," *Engineers Garage*, Jun. 25, 2019. https://www.engineersgarage.com/measuring-room-temperature-with-lm35-using-arduino/ (accessed Sep. 09, 2021).

Code

```
#include<LiquidCrystal.h>

LiquidCrystal lcd(5,6,8,9,10,11); // RS,E,D4,D5,D6,D7

int SensorPin = A0;
int tempSensorPin = A1;
int relay = 7;
int ledLight = 3;
int sound = 4;
float temp, com = 30;
int pampVal = 0;

void setup() {

  pinMode(relay, OUTPUT);
  digitalWrite(relay, LOW);

  pinMode(sound, OUTPUT);
  digitalWrite(sound, LOW);

  pinMode(ledLight, OUTPUT);
  digitalWrite(ledLight, LOW);

  lcd.begin(20,4);

}

void loop() {
  int SensorValue = analogRead(SensorPin);
  SensorValue = map(SensorValue, 1019, 19, 0, 100);
  float temp = analogRead(tempSensorPin);
  temp = temp*5000/(1024*10);

  lcd.setCursor(0,0);
  lcd.print("--SMART IRRIGATION--");
```

```
lcd.setCursor(0,1);
lcd.print("MOISTURE LEVEL:");
lcd.setCursor(0,2);
lcd.print("TEMPERATURE: ");
lcd.setCursor(2,3);
lcd.print("PAMP: ");

if(SensorValue >= 70)
{
    lcd.setCursor(16, 1);
    lcd.print(SensorValue);
    lcd.print("%");
    lcd.setCursor(13, 2);
    lcd.print(temp);
    lcd.print(" C");
    lcd.setCursor(10, 3);
    lcd.print("OFF");

    digitalWrite(relay, LOW);
    digitalWrite(ledLight, LOW);
    digitalWrite(sound, LOW);

}
  else if(SensorValue < 70 && temp < 40)
  {
    lcd.setCursor(16, 1);
    lcd.print(SensorValue);
    lcd.print("%");
    lcd.setCursor(13, 2);
    lcd.print(temp);
    lcd.print(" C");
    lcd.setCursor(10, 3);
    lcd.print("ON");

    digitalWrite(relay, HIGH);
    digitalWrite(ledLight, HIGH);
    digitalWrite(sound, LOW);

  }
  else if(temp >= 40 && SensorValue < 70
  {
    lcd.setCursor(16, 1);
    lcd.print(SensorValue);
    lcd.print("%");
    lcd.setCursor(13, 2);
    lcd.print(temp);
    lcd.print(" C");
    lcd.setCursor(10, 3);
    lcd.print("OFF");

    digitalWrite(relay, LOW);
    digitalWrite(ledLight, LOW);
    digitalWrite(sound, HIGH);

  }


  delay(5000);
  lcd.clear();


}
```