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Automatic Irrigation System using Soil Moisture Sensor

A Project Report

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ABSTRACT

Turkey is mainly an agricultural country. Agriculture is the most important occupation for the most of the Turkish families. It plays very important role in the development of agricultural country. In Turkey Agriculture is the largest user of water with 75% of the total consumption. Turkey has developed 50 percent of total irrigable land so far. Water is a limiting factor for agriculture in Turkey. In Turkey Irrigation systems are generally based on conventional irrigation methods, using classical open channel systems or released canals.

Now a day's water is becoming very precious Most of the water-scarce countries are depleting groundwater faster than its natural recharge, thus lowering the water level, increasing the cost, decreasing the quality and eventually creating major problems for future generations.

In order to optimize the use of water, mechanism to develop water conversation is the need of the hour. Also, automation in agricultural systems is a necessity to optimize water usage, reduce water wastage, and to implement modern technology in agriculture systems.

INTRODUCTION

According to statistics, agriculture uses 75 % of available freshwater resources of Turkey, and this percentage will continue to be dominant in water consumption because of population growth and increased food demand. The decrease in water resources day by day, and therefore the increase in irrigation water costs, necessitates the irrigation method to be more sensitive.

By using network technology we can control water usage and to maximize the scientific technologies in this irrigation methods. So it can highly improve the usage of water and can increase water productivity.

Soil moisture sensor is a new device which senses the moisture content in the soil, and with suitable mechanism allows water to be irrigated depending on the moisture content of the soil. Irrigation is one method to supply water but in some cases there will be lot of water wastage. So, in this regard to save water and time we have proposed project titled automatic irrigation system.

This is a microcontroller based control system used for data processing. The activation of the pump to supply water through the tunings connected to the pump depends upon the signals received through the sensing mechanism. The purpose is to regulate water and optimize the water flow so that plants are not starved of water. This is particularly useful during summer seasons when water is scarce.

Objectives

An automation of irrigation systems has several positive effects. Once installed, the water distribution on fields or small-scale gardens is easier and does not have to be permanently controlled by an operator. There are several solutions to design automated irrigation systems. Modern big-scale systems allow big areas to be managed by one operator only. Sprinkler, drip or subsurface drip irrigation systems require pumps and some high tech-components and if used for large surfaces skilled operators are also required. Extremely high-tech solutions also exist using GIS and satellites to automatically measure the water needs content of each crop parcel and optimize the irrigation system. But automation of irrigation can sometimes also be done with simple, mechanical appliances: with clay pot or porous capsule irrigation networks or bottle irrigation

- 1)The main objective of this work is to control the water application.
- 2)As well saving our time is major purpose.
- 3)To save the plants from being dry and improve their lifetime.

Motivation

In the current situation, water shortage due to increased exploitation has urged to develop a new technology which can save water from wasting and therefore there will be a smart way to check the loss of water. The purpose of this idea is to make the water planting system smart, autonomous, and efficient, to optimize the water supply to the plants to decrease manual intervention. It observes soil, climate, dehydration conditions and plant water consumption and automated adjustment of the water schedule. Irrespective of human presence the plant survives on its own. Therefore, smart water planting system has become a major concern so that a smart device can be given to the owner who can maintain productivity of plant.

Challenges

Hence as far as our project deals with automating the water and waste water management systems is concerned, many smaller initiatives have been seen. But large scale demonstrators and completely integrated solutions are still in conception. Some technical challenges related to these systems are sensor/ probe designs energy consumption and efficiencies of field devices, real time sensing, robust communication infrastructure, seamless integration of technologies, redundancy of networks, reliable data transfer in case of both surface and underground sensors, time synchronization, security, prediction and data gathering

mechanisms for better building of measurement models etc. Sequence of system scenario has been not easy to decide to function. The controllers to the Arduino were quite challenging, because a single mistake can damage any electrical part. It was not easy to write the software for the Smart Irrigation System and reading the values using sensors and upload it in software to run the system and to predict the values to water or not and finally completed with perfect results.

LITERATURE SURVEY

- 1) Arduino Based Automatic Water Planting System using Soil Moisture Sensor
- 2) Automated Irrigation System
- 3) Soil moisture sensor for Automatic Irrigation Systems

Identifying Soil Humidity Content by Automatic Irrigation Methods

An extraordinary plan is done on "Identifying Soil Humidity Content in Automatic Irrigation Methods" is proposed in an effort to enhance an automatic irrigation strategy that controls the pumping motorized via turn it the machine On or Off due to detecting the moisture quantity of the soil. Proved that using automated irrigation techniques enables to minimize the mistakes of operation due to employees and apply suitably automated irrigation to the agriculture field.

This project conveys by Arduino board called (ATmega328 micro-controller), which is assemble input sign of variable moisture conditions via special moisture sensing method. The project illustrates that water can be controlled and corrected in the amount of usage in crops by using a moisture sensor, to protect the valuable soil and to maintain the quantity of water needed for crops irrigation.

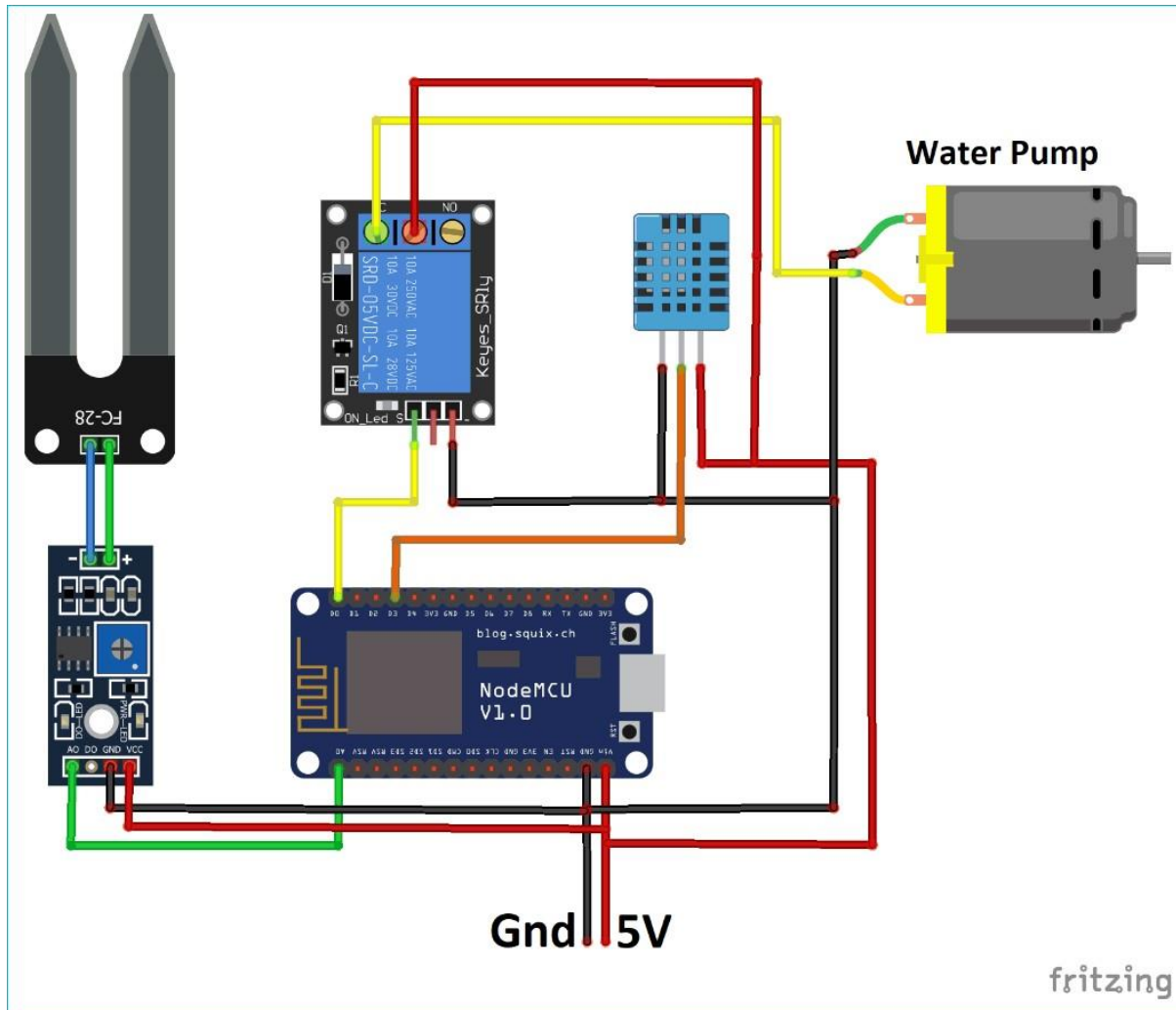
METHODOLOGY

The system method includes automatic controlled irrigation is the use of soil moisture sensor. The Arduino programmed using arduino IDE software. A moisture sensor is used to detect the soil moisture level. Motor or pump is used to supply water to crops. The microcontroller (Arduino Uno R3) is the brain of the system. Moisture sensor is connected to the controllers input. Pump coupled to the output pin. In case if soil moisture value is less than the threshold, the system automatically triggers the water pump until the sensor meets the threshold and then sets off automatically.

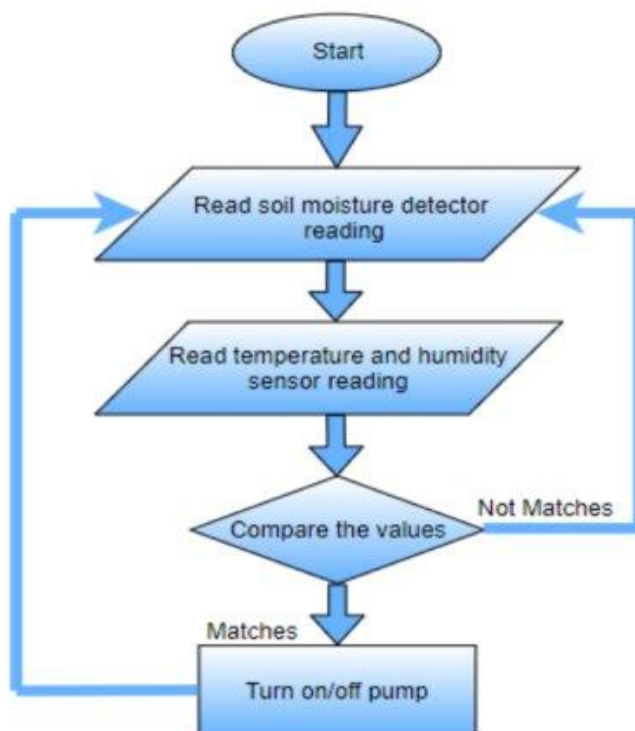
I. Components of Automatic Irrigation System:

- A. Power supply:** As this electronic device is power operated, the controller and other devices used are low power devices. The voltage has to be step down to obtain a constant DC output
- B. The Arduino Uno or Raspberry pi:** They are microcontrollers based board connected to the power supply.
- C. GSM Module:** It is used to send and store messages. It also alerts the user of any specific data. It is handy and can be carried anywhere easily.
- D. Relay:** A simple relay is used to open or close a circuit. It can energize and de-energize the system according to the inputs
- E. Moisture sensor:** It consists of a probe consisting of moisture sensors which can be inserted in the soil, in order to measure the moisture content of the soil. When the field is in dry condition, the sensor device senses the condition of the soil and the signal is transmitted to the microcontroller. which in response makes the motor ON. Now, the water is pumped and the irrigation is done at the dry places only. This is done by moisture sensor device. Where there is moisture present in the soil, irrigation process will stop and vice-versa. Soil moisture sensors measure the water level in soil.

Automatic Watering System using Soil Moisture Sensor Prototype



Flowchart for soil moisture sensor module



This below Figure 1 is a overall block diagram of automatic irrigation system which consist of three sensors which are connected to controller and sensed values from these sensors are send to the mobile application .

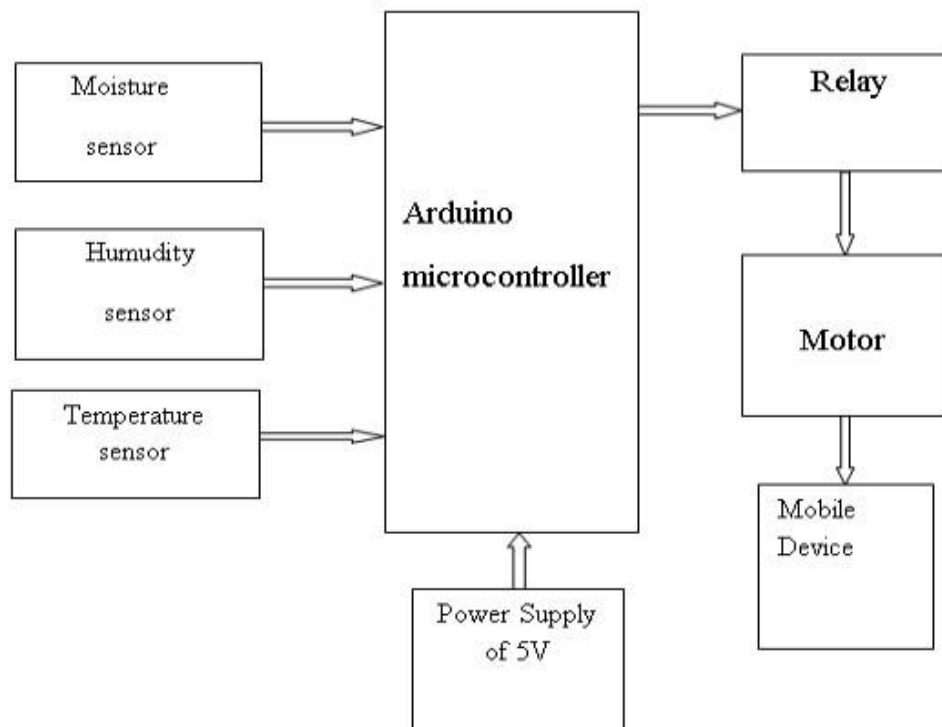


FIGURE 1

This proposed work includes an embedded system for automatic control of irrigation. This project has wireless sensor network for real-time sensing of an irrigation system. This system provides uniform and required level of water for the Automation of irrigation system using IoT 81 agricultural farm and it avoids water wastage. When the moisture level in the soil reaches below threshold value then system automatically switch ON the motor. When the water level reaches normal level the motor automatically switch OFF. The sensed parameters and current status of the motor will be displayed on user's android application

Components of Industrial Automatic Irrigation System:

I. Monitoring center:

- **Hardware:** servers, computers, printers, large display screens, switches, etc. To
- **Software:** water-saving irrigation system platform, database software, and operating system software.

II. Valve Control System

III. Communication Network

IV. Soil Moisture Monitoring System

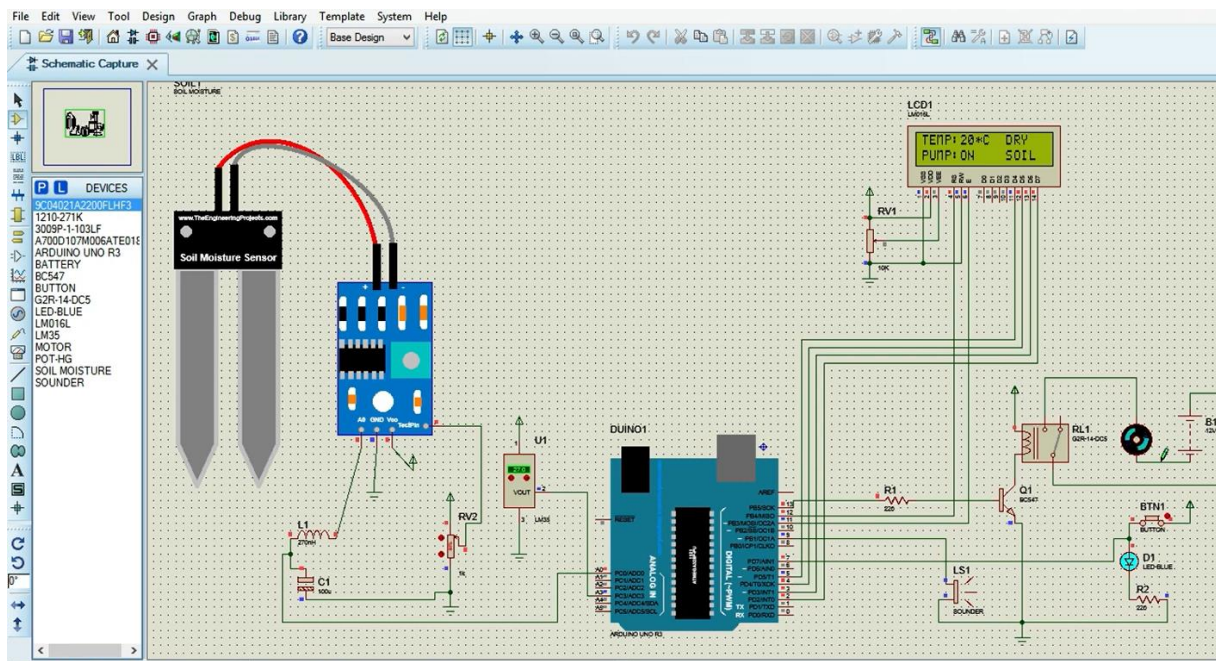
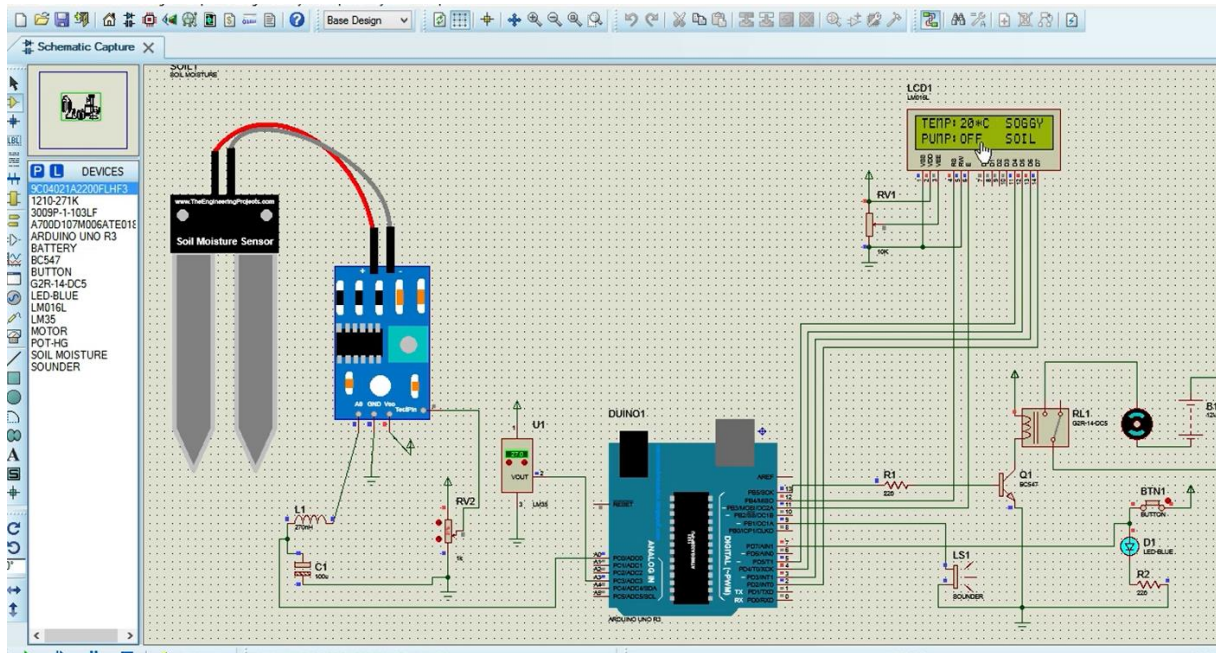
V. Water Pump Monitoring System

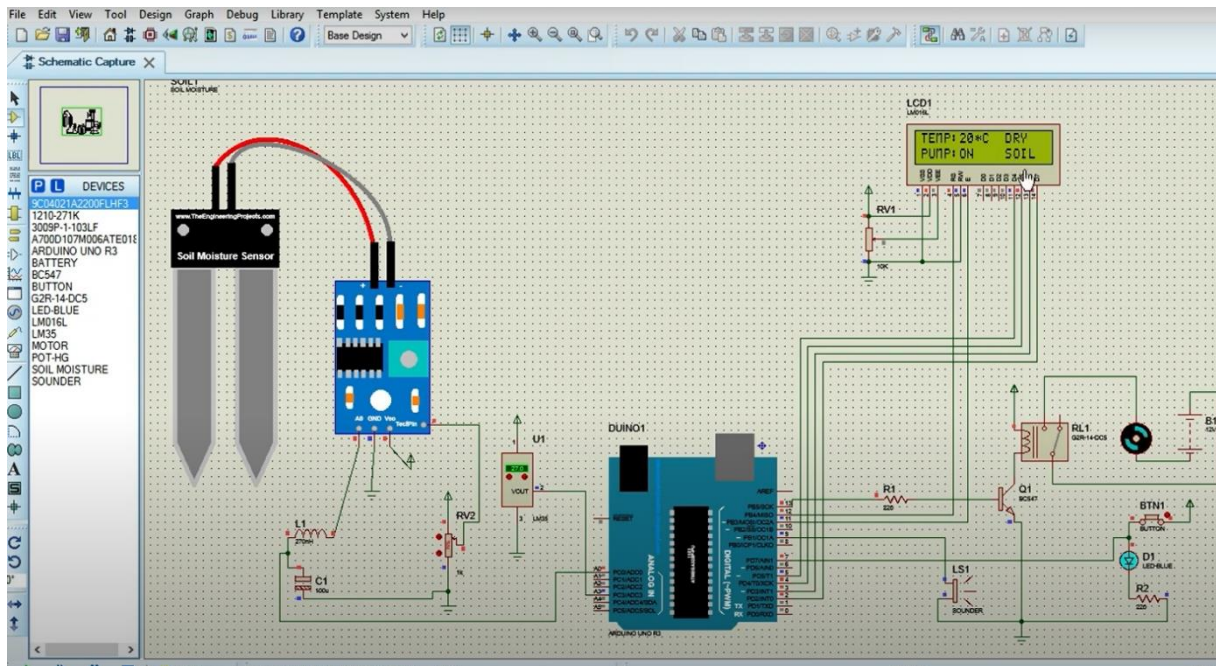


FIGURE 1

My Project Simulation Screen Shots

Design and working of my Project is on Proteus 8

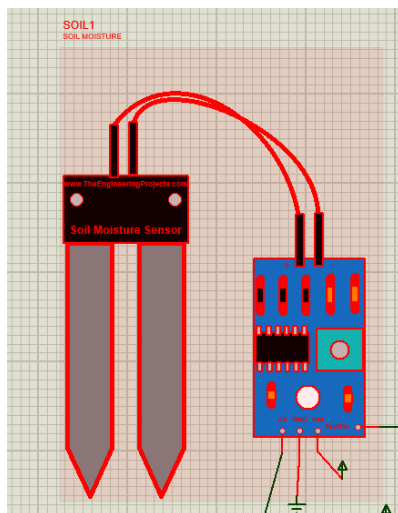




Component Description

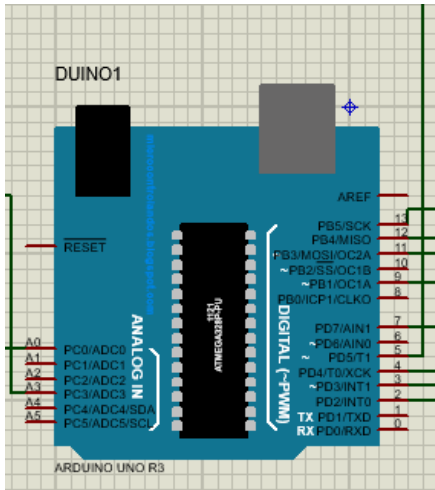
Soil Moisture Sensor

The soil moisture sensor is a sensor connected to an irrigation system controller that measures soil moisture content in the active root before each irrigation event and bypasses the cycle if soil moisture is above user defined set point.



Arduino Uno R3

Arduino UNO is a low-cost, flexible, and easy-to-use programmable open-source microcontroller board that can be integrated into a variety of electronic projects. This board can be interfaced with other Arduino boards and can control relays, LEDs, servos, and motors as an output.



Water pump It is used in this project to pump the water needed for irrigation from the main water tank through pipes. This pump can be used for different applications, in household include cleaning, bathing, space heating and flower of water



HK-300/055

Battery An electric battery is a source of electric power formed of one or more electro chemical cells with external connections for powering electrical devices.



LCD 16x2(LM016L) A liquid crystal display or LCD draws its definition from its name itself. It is a combination of two states of matter, the solid and the liquid. LCD uses a liquid crystal to produce a visible image. Liquid crystal displays are super-thin technology display screens that are generally used in laptop computer screens, TVs, cell phones, and portable video games.



Relay module Relay is an electrically operated switch. Many relays for switching solenoid mechanism mechanically operated, but can also be used for other principles of operation. Relays are widely used in early computers to telephones and perform logical operations.

Working Principle Of the Circuit

- The objective of the my project is to implement an automatic irrigation system by sensing the moisture of soil or sand. The working of the above circuit is follows.
- Soil moisture sensor is inserted in the soil. Depending on the quality of the sensor, it must be inserted near the roots of the plant. The soil moisture sensor measures the conductivity of the soil.
- Wet soil will be more conductive than dry soil. The soil moisture sensor module has a comparator in it.
- The voltage from the prongs and the predefined voltage are compared and the output of the comparator is high only when the soil condition is dry.
- This output from the soil moisture sensor is given to the analogue (A0) input of the microcontroller
- When the moisture in the sand or soil is above the set point, the microcontroller displays a message telling the same and the motor is off.
- When the output from the soil moisture sensor is high the moisture of the soil is less. This will trigger the microcontroller and displays an appropriate message on the LCD and the output of the microcontroller, which is connected to the base of transistor is high.
- When the transistor is turned on, the relay coil gets energized and turns on the motor. The LED is also turned on and acts as an indicator.
- When the moisture of the soil or sand or etc. reaches the threshold value, the output of the soil moisture sensor is low and the motor is turned off.

My Arduino Codes

```
batur_uretir_auto_irrigation | Arduino 1.8.13
Dosya Düzenle Taslak Araçlar Yardım

batur_uretir_auto_irrigation

#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;

    lcd.setCursor(0,0);
    lcd.print("Düzenler Bu");
}

Kaydedildi.
```

```
batur_uretir_auto_irrigation | Arduino 1.8.13
Dosya Düzenle Taslak Araçlar Yardım

batur_uretir_auto_irrigation

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_F4, 500);
        }
    }
}

Kaydedildi.
```

batur_uretir_auto_irrigation

```
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);
}
```

Kaydedildi.

Advantages Of Automatic Irrigation System Using Soil Moisture Sensor

The automatic irrigation system realizes intelligent irrigation: as long as the irrigation program is set, it can be fully automatic operation, automatically closed on rainy days, and automatically opened on sunny days.

The automatic irrigation system realizes precise irrigation: the lawn, flowering shrubs, grass flowers, and moss are controlled in zones, and different irrigation procedures are set to meet the water requirements of different plants and realize precise irrigation management.

Automatic irrigation systems can save labor: in garden management, with this intelligent irrigation system, there is no need to water manually, and more time can be saved to take care of other details.

CONCLUSION

The main objective of this project is to improve an automatic irrigation system using soil moisture sensor so saving water and saving money and time of farmers. It is to benefit from the most efficient and use by taking advantage of the presentation of technology to us. The use of these irrigation systems and control devices or centralized control aids in optimum water management. Traditional and commonly used farm land irrigation techniques require manual intervention. With soil moistured automatic irrigation technology human intervention can be minimized.

The application of soil moistured automatic irrigation systems has changed human mistakes, randomness, and blindness of operation . It can not only increase the utilization rate of the water sources. It can decrease the labor(manpower) so, It is the used to place irrigation devices as a date of use, as there is a continuous monitoring of an irrigation schedule. Soil moistured automatic irrigation systems are more iclined to irrigate when the plans need water and are suitable for the irrigation. It can also enables the precise application of the amount of water, ensuring optimim growth of plants and lawns. The agricultural automatic irrigation system based on soil moisture sensor technology is the only way for the world to develop high-efficiency agriculture.

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Smart Irrigation System with Soil Moisture Detection and Automatic Plant Watering Pramod Kumar Maurya¹, Prerna Sultania², Saloni Uday Parekh³, Shreya Maheshwari⁴, Shashank K Drolia⁵, Bharat Joshi⁶ and Divyansh Chaudhary⁷

Automatic Watering System using Soil Moisture Sensor and RTC timer with Arduino Know the Plant and Grow the Plant Dr. Geetha S¹, Dr. Y. Asnath Phamila², P Vaishnavi³, Y Lakshmi Sai Charitha⁴, T Jayasri⁵, Manchikanti Bhumika⁶, Nelakurthi Sudheer Kumar⁷

