AUTOMATIC PLANT WATERING SYSTEM USING ARDUINO

16MCL81 - PROJECT REPORT

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ABSTRACT

In daily operations related to farming or gardening Watering is the most important cultural practice and the most labor-intensive task. No matter whichever weather it is, either too hot and dry or too cloudy and wet, you want to be able to control the amount of water that reaches your plants. Modern watering systems could be effectively used to water plants when they need it. But this manual process of watering requires two important aspects to be considered: when and how much to water. To replace manual activities and making gardener's work casier, we have created automatic plant watering system. In this project we used DC motor to make water pump, NPN transistor is used to control the switching activity of the motor according to the code. Arduino pin 13 (named as WATERPUMP in code) is used to turn on and off the transistor. According to the code to control the speed of the motor we need to enter a value between 0 and 255 in the Serial Monitor. The soil moisture sensor allows the current to pass through the soil and in return calculates the resistance value to measure the moisture level. If there is more water in soil then soil will conduct more electricity, means less resistance value along with high level of moisture. In the same manner if there is less water in soil then soil will conduct less electricity, means high resistance value along with low level of moisture. In this system, soil moisture sensor senses the moisture level of the soil. If soil will get dry, then sensor senses low moisture level and automatically switches on the water pump to supply water to the plant. As plant get sufficient water and soil get wet then sensor senses enough moisture in soil. After which the water pump will automatically get stopped.

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CHAPTER-1

INTRODUCTION

The process of producing foods by plants or trees is called Photosynthesis. During photosynthesis, plants and their organisms use Carbon Dioxide from Air and Water from soil or other source in the presence of light and produce Sugar and Oxygen. The chemical reaction occurs in photosynthesis is:

$$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$$

Carbon dioxide Water sugar oxygen

The core elements of photosynthesis are light, water and carbon dioxide, which they need together during photosynthesis. Plants can get the carbon dioxide anytime as it can be found from the air and daylight can be provided if it is kept in the right place. Most of the time for lack of water, the plants cannot raise well and become morbid. On the other hand, supply of excessive water at a time can result a venturesome effect on the plants especially the sensitive trees like bonsai. Such trees also need timely water supply for the perfect growth. That means, for the perfect growth, water is needed in proper time along with proper quantity. Currently there are some micro-controller-based plant watering projects available, but the problem with the projects is, they don't have a particular time for watering. But there are some sensitive and expensive plants which need water at the time and unusual watering could cause them to death. Moreover, the best time for watering is early morning, while the environment is cool. This allows water to go into deep and reach the roots of the plants without too much excess water lost to vaporization. Watering at night could cause damage in the base of the plant and could also be responsible for fungal problems such as, powdery mildew or sooty mold, which is very harmful for plants. Besides, the existing works do not have the feature to track any leakage in water supply or identify the shortage in the water source. As a result, any implausible situation can be created in absence of person at home.

Hence, an automatic watering plant that works both in the rainy season and the dry season is necessary to design. The device used a microcontroller chip programmed based on the detection of agricultural soil moisture sensors. When the soil was dry, the device automatically watered the plants. Conversely, if the soil was wet, the device would not water them. It led to healthy plants because the need for water had been fulfilled all the time.

1.1 Problem Statement

During day-to-day activities many people often forget to water their plants and thus it becomes challenging for them to keep their plants healthy and alive. Also, it is a challenge for farmers to maintain their fields and manage watering of plants during shortage of water. To make the work easy for farmer then save the time and to make the plant proper growth this Automatic Plant Watering System is used. We can implement this prototype in sprinklers or drip emitters for effective irrigation.

1.2 Aim

Main objective of this project is to fully automate plant watering system using Arduino. In this system, soil moisture sensor senses the moisture level of the soil. If soil will get dry, then sensor senses low moisture level and automatically switches on the water pump to supply water to the plant. As plant get sufficient water and soil get wet then sensor senses enough moisture in soil. After which the water pump will automatically get stopped.

CHAPTER-2

LITERATURE REVIEW

Many times, due to busy schedules, people forget to water their plants, which hinder their healthy growth. Also, it is very difficult for farmers to water their fields manually and to provide accurate amount of water for healthy growth of plants. To solve these problems Automatic Plant Watering System is implemented**.** Manisha Mayuri, Priyanka Aishwarya, prof. Bagubali A published "Automatic Plant Watering System" in International Conference-2019 (ViTECoN).

Irrigating field is the most important and very laborious task for the farmers, especially in the summer season and its time consuming. Auto watering systems can be efficiently used to water plants when needed, which controls when and how much watering needs to be done. Ahmed Imteaj, Tanveer Rahman, Mohammed Shamsul Alam, and Touhidul Alam published "Automated Expedient Watering System for Small Plants and Acquaintance About Deficit in Water Supply" in ICERIE-2017.

In Agriculture field water is main resource, to use that resource properly without wastage and to make the work easy for farmer then save the time and to make the plant proper growth this Automatic Plant Watering System is used. We can implement this prototype in sprinklers or drip emitters for effective irrigation. Rakhade R.D, Patil N.V Published "Design and Manufacturing of Automated Agricultural Irrigation System" in International Journal of Technical Innovation Modern Engineering and Science, Volume 4, Issue 8, Aug-2018.

There are two functional components in this paper. They are moisture sensor and motor / pump. Arduino board is programmed using the Arduino IDE software. Motor / pump is used to supply water to plants. Soil moisture and temperature predetermined range is set particularly for specific plants requirement, and according to that system is being operated. Punitha.K, Shivaraj,

Sudarshan Gowda, Devarajnayaka R, Jagadeesh Kumar H. B. "Automated Plant Watering System" in INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH & TECHNOLOGY (IJERT) ,24-04-2018.

Indonesia is a maritime and agricultural country with rainy and dry seasons. In the rainy season, food plants usually do not need to be watered, while in the dry season, the plants must be watered regularly according to the soil moisture conditions. Farmers usually do not grow food plants in the dry season for fear that it will not grow well. The farmer's dependence on the season causes the production to decline and becomes an obstacle in the success of the food self-sufficiency program. An information and communication technology-based agricultural device is needed to overcome the problem. There search aimed to design a programmed microcontroller chip to control watering automatically based on soil moisture detected using a domestic soil moisture sensor. This device detected whether the soil was dry or not. The farmers did not need to do watering manually. In addition to helping farmers, the device could also be installed on plantations, seedbed nurseries, urban parks, hotels, offices, and home The designed automatic plant watering device uses a copper plate sensor working as an electrode to measure soil resistance that is converted into analog voltage and then into digital data so that it can be processed by the Arduino Uno processor. The determination of the upper limit for the watering process is carried out by trials on different soil conditions.] Ipin Prasojo1, Andino Maseleno2, Omar tanane3, Nishith Shah "Design of Automatic Watering System Based on Arduino" Journal of Robotics and Control (JRC)Vol. 1, No. 2, 2020, March 2020, pp. 55-58.

In this paper, automatic plant watering system by using Arduino was successfully established and tested. As the automatic plant watering system has a user-friendly design so it is used by the household users as well as the commercial user. The best benefit is that it reduces the wastage of water during irrigation and helps in saving the precious water resource. Another is saving time, optimal water

supply to plant or crop, automatic operation, and protection against adverse weather conditions. The advantages of this paper are numerous. If this technology is implemented in the real world, a lot of water is saved. The world uses about 70% of fresh water for irrigation and on the other hand irrigation multiplies yield of most crops by almost 2 to 5 times. So, irrigation is a necessary evil. The best solution out of this paper is controlled usage of water for irrigation purpose. Khin Thandar Tun , Hay Man Oo , Cho Thet New, "AUTOMATIC PLANT WATERING SYSTEM USING ARDUINO" © IJCIRAS | ISSN (O) – 2581-5334August 2019 | Vol. 2 Issue. 3.

In day-by-day activities identified with cultivating or garden watering are the most significant social practice and the most labour-intensive task. No mater whichever climate it is, either hot, dry, cloudy, or wet, you need to have the option to control the measure of water that arrives at your plants. Present day watering frameworks could be successfully used to water plants when they need it. So as to supplant manual exercises and make work simpler, automatic plant watering framework is made. It utilizes the innovation to identify the moisture level of the soil and automatically water the plant when there is no moisture recognized in the soil. Automated irrigation system optimizes the usage of water by reducing wastage of water. This project can be able to Contribute towards socio-economic development of the nation. It has fast response and system is user friendly. The Primary application of this project is for formers and gardeners who do not have sufficient time to water their crops or Plants regularly. This project also covers an application for formers who are wasting water unknowingly during Irrigation. The main objective of this smart irrigation system is to make it more innovative, user friendly, time saving and more efficient than the existing system. Rohit Kumar Dulani1, Sanket Gapat2, Deven Nalawade3, Atharv Parbalkar4, Ali Aslam5 Pruthviraj Mashalkar6, "Automatic Plant Watering System using Arduino" International Journal of All Research Education and Scientific Methods (IJARESM), ISSN: 2455-6211, Volume 9, Issue 6, June -2021.

In this project, automated plant watering system have been implemented and it measure the existing plant and then supplies desired amount of water needed by that plant. Moisture content of the soil of plants or cultivated land can be controlled. The code is written in such a way that, it is programmed to sense moisture level of plants at particular instance of time. If the moisture content is less than specified threshold which is predefined according to particular plant's water need then desired amount of water is supplied till it reaches threshold. Also, it is minimizing the excess water use as well as taking care of the plant. The system works on the principle of measuring the soil moisture level by Means of the sensor technology using Arduino UNO,L239DIC & DC motor. In order to provide the plant Enough amounts of water, when necessary, the project may need to minimize the efforts of major agricultural Regions. Many aspects of the system can be customized and used software to fine-tune the requirements of the Plant. The result is a scalable, supporting. Tasneem Khan Shifa, " Moisture Sensing Automatic Plant Watering System Using Arduino Uno" American Journal of Engineering Research (AJER), e-ISSN: 2320-0847 , Volume-7, Issue-7.

CHAPTER-3

COMPONENTS SELECTION

3.1 5V Relay module

Figure 3.1 5V Relay module

5V relay module is the most key component in this project. Instead of using a relay and wiring it up with transistors, diodes and resistors or any other additional components, a relay module board like this already includes everything you need. 5V Relay module is shown in above Figure 3.1.

A relay is an electrically actuated switch. Many sensors are incredibly sensitive, and which may produce only small electric currents. When we need to use them in circuits involving larger currents, that's when relays bridge the gap; A relay makes it possible for small currents to activate larger ones, and to safely do so. The relay is used to turn the submersible water pump on and off.

Three of its pins control the state of the relay:

VCC: In this guide, we connected it to 5V

GND: Connected to GND.

Input (IN): This is the signal connection that is used to control the relay.

Three of the other connections control the circuit:

NC - Stands for 'Normally closed'. it is connected to COM when there is a trigger in the relay.

NO - Stands for 'Normally open'. It is normally connected to COM when there

is no trigger in the relay.

COM - Stands for 'Common'. it is the part of the relay that moves.

When a relay is off, COM is connected to NC. When the relay turns on, it moves from NC to NO

3.2 Soil Moisture Sensor

The water content in surrounding air and materials such as soil is a key factor for the well-being of humans, animals, plants, and other living things. The term moisture refers to the water content of any material. It is applied to liquids and solids, whereas humidity refers to the water vapor content in gases. This soil moisture sensor consists of two probes to pass current through the soil figure 3.2. It measures the resistance and represents the change in resistance as moisture level. More water makes the soil conduct electricity more easily (less resistance), while dry soil conducts electricity poorly (more resistance). This sensor will be helpful as a reminder to water your indoor plants or to monitor the soil moisture in your garden. A closer look at the pins: There are two pins on the soil moisture sensor, these connect to the two other pins on the top of the module.

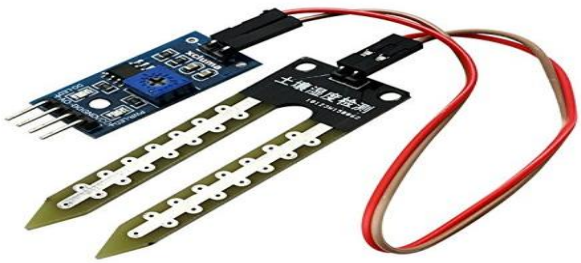

Figure 3.2 Soil Moisture Sensor

There are four pins on the module:

AO: Analog Output.

DO: Digital Output.

VCC: 'VCC' stands for Voltage Common Collector. We will connect the VCC pin to 5V on the Arduino.

GND: In electronics, we define a point in a circuit to be a kind of zero volts or 0V reference point, on which to base all other voltage measurements. This point is called ground or GND.

Voltage is the difference in potential between two points. As it is difficult to talk about voltage without a reference point, we need another point to compare it to.

3.3 Arduino

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards can read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. We can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so we use the Arduino programming language (based on wiring), and the Arduino Software(IDE), based on Processing.

Figure 3.3 Arduino Uno

The Arduino Uno Figure 3.3 can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector. The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V

pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

3.3.1 Arduino Specification

Table:3.1 Arduino Specification

FEATURE	SPECIFICATION
Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage(recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14(of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pins	40 mA
DC Current for 3.3V Pins	50 mA
Flash Memory	32 KB (ATmega328) of which 0.5KB Used by boot loader
SRAM	2 KB (ATmega328)
EEPROM	1 KB (ATmega328)
Clock Speed	16 MHz

3.4 Pump and Battery

Figure 3.4 Pump

We need a small pump to irrigate the plant, but in the case of a garden, we need to drive a larger pump that can provide a higher volume of water depending on the size of your garden which cannot be directly powered by an Arduino. So, in case you need to operate a larger pump Figure 3.4 , a driver is necessary to provide enough current for the pump, to show that we are using a 5v relay. You can also use an AC-powered pump and use a suitable relay. The working will remain the same as shown in this project, you just have to replace the DC power input connected to the relay with an AC power input and have to power your Arduino with a separate DC power source.

Figure 3.5 Battery

To power the circuit, we are using an external Battery Figure 3.5. Any 9v or 12-volt battery can be used. The battery is connected to the Vin and ground pins of Arduino, and we can also connect the motor to this battery via a relay. Moisture sensor output is connected to the analog pin of Arduino. Do remember to use the Arduino's 5volt pin to power the sensor and relay module.

3.5 LCD (Liquid Crystal Display)

The LCD (Liquid Crystal Display) is a type of display that uses the liquid crystals for its operation. Here, we will accept the serial input from the computer and upload the sketch to the Arduino. The characters will be displayed on the LCD Figure 3.5.

Figure 3.6 LCD (Liquid Crystal Display)

3. 6 Breadboard and Jumper Wires

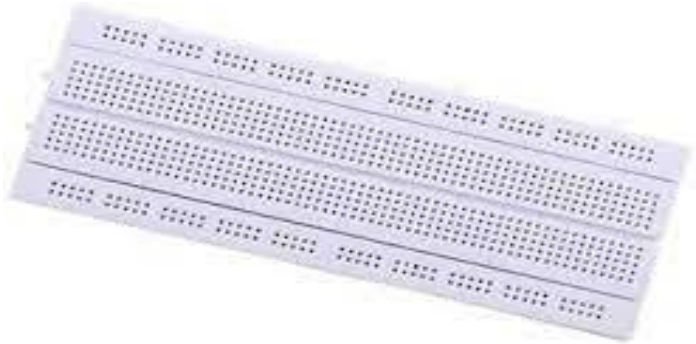

Figure 3.7 Breadboard

A thin plastic board used to hold electronic components (transistors, resistors, chips, etc…) that are wired together. Used to develop prototypes of electronic circuits, breadboards can be reused for future jobs. The breadboard contains spring clip contacts typically arranged in matrices with certain blocks of clips already wired together Figure 3.7. The components and jump wires (assorted wire lengths with pins at both ends) are plugged into the clips to create the circuit patterns. The boards also typically include metal strips along the side that are used for common power rails and signal buses.

Figure 3.7 Jumper Wires

Jumper wires are used to connect two points in a circuit. All Electronics stocks jumper wire in a variety of lengths and assortments. Frequently used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed. Male jumpers are designed to plug securely into the holes in a breadboard. Female jumpers are useful for connecting male header posts and pin terminals on components. Jumpers are available in female-female, male-male and male-female configurations.

CHAPTER-4

SYSTEM DESIGN

4.1 Circuit Diagram and Working

Circuit diagram:

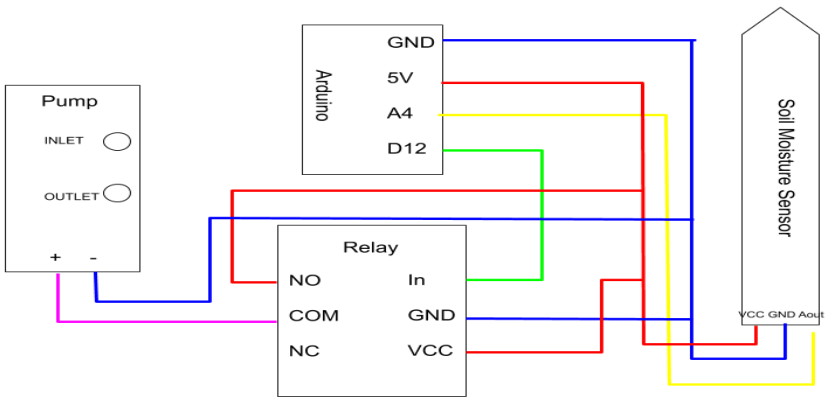

Figure 4.1 Circuit Diagram

First, take the power lines onto the breadboard from the microcontroller **VCC/5v–>+ line** and **GND–> – line**.

Then connect the sensor to the breadboard and connect power to the sensor from powerlines using jumper wires. Now connect **OUT PIN OF SENSOR TO MICROCONTROLLER DIGITAL PIN 3.**

Now connect led to the breadboard – to GND in series with resistor and + wire of different colour to Arduino pins as shown in the figure. Also connect I2C LCD, Relay, and Pump according to the diagram above Figure 4.1.

Working :

Code starts with initializing the library used in the project and then sets the I2C LCD address and starts it. In void setup, it set the pin modes as INPUT or OUTPUT. And start displaying on LCD. In a loop, it then reads the value from the soil moisture sensor and according to the condition changes the colour of the led and also tuns on or off the pump along with displaying on LCD.

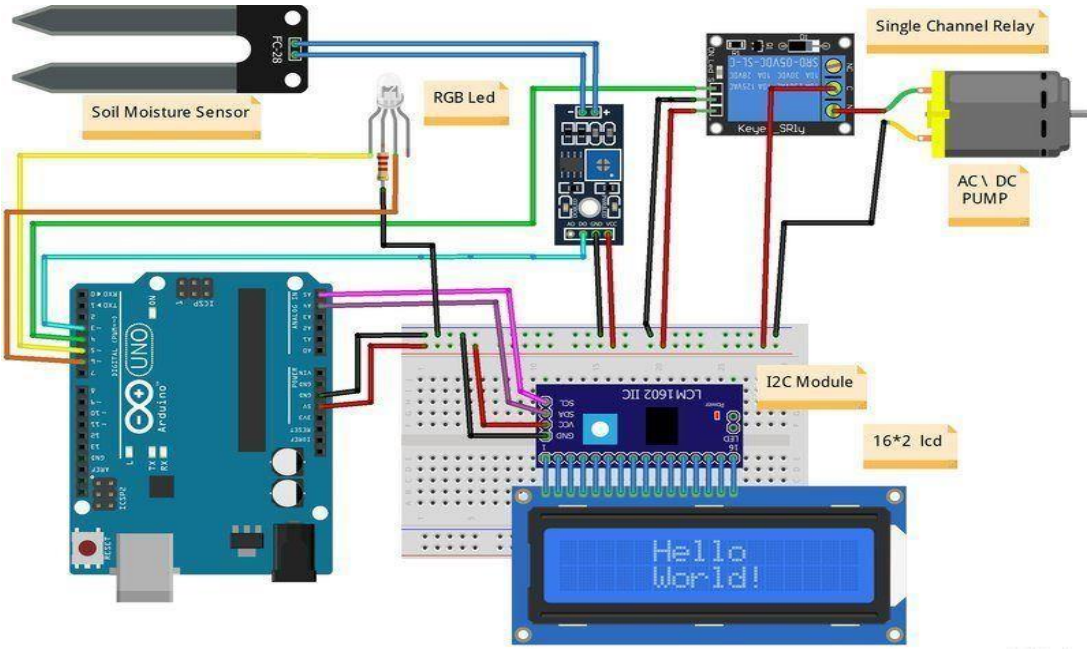

Figure 4.2 Circuit Diagram

Table:4.1 Circuit Connections

Arduino UNO	**Soil Moisture Sensor**
D3 Pin	DO OUT Pin
(+5V) VCC	VCC , (+ 5V)
GND (Ground)	GND
Arduino UNO	**I2C LCD Module**
A4 Pin (SDA Pin)	SDA Pin
A5 Pin (SCL Pin)	SCL Pin
(+5V) VCC	VCC
GND (Ground)	GND (Ground)
16 * 2 LCD	**I2C LCD Module**
16 Connect	16 Connect
Arduino UNO	**Single Channel Relay Module**
D4 Pin	IN1
+5 VCC	VCC
G, GND	GND

Table:4.2 Circuit Connections

DC Water Pump	**DC Supply**	**Relay Module**
		Normally open
	Positive	Common
Terminal 1		Normally closed
Terminal 2	Negative	
Arduino UNO	**RGB LED**	**220-ohm Resistor**
D5 Pin	Terminal 1	
	Terminal 2	Terminal 1
D6 Pin	Terminal 3	
D8 Pin	Not Connect	
GND		Terminal 2

4.2 Code

```
int motorPin = 3;              // pin that turns on the motor
int blinkPin = 13;             // pin that turns on the LED
int watertime = 5;             // how long it will be watering (in seconds)
int waittime = 1;              // how long to wait between watering (in minutes)
void setup()
{
  pinMode(motorPin, OUTPUT);    // set Pin 3 to an output
  pinMode(blinkPin, OUTPUT);    // set pin 13 to an output
  Serial.begin(9600);
}
void loop(){
  int moisturePin = analogRead(A0);      //read analog value of moisture sensor
```

```
  int moisture = ( 100 - ( (moisturePin / 1023.00) * 100 ) );   //convert analog value to percentage
Serial.println(moisture);
  if (moisture < 40) {            //change the moisture threshold level based on your calibration values
    digitalWrite(motorPin, HIGH);       // turn on the motor
    digitalWrite(blinkPin, HIGH);       // turn on the LED
    delay(watertime * 1000);            // multiply by 1000 to translate seconds to
                                        //  milliseconds
  }
  else {
    digitalWrite(motorPin, LOW);       // turn off the motor
    digitalWrite(blinkPin, LOW);       // turn off the LED
    delay(waittime * 60000);     // multiply by 60000 to translate minutes to milliseconds
  }
}
```

To adjust how long it will be watering each time, simply change :

int water time = 5;

To adjust the wait time between watering, simply change:

int waittime = 1;

To adjust the moisture threshold level, change the conditional statement:

if (moisture < 40)

4.2.1 Code to calibrate soil moisture sensor

```
void setup() {
Serial.begin(9600);                    // initialize serial communication
}
void loop() {
  int moistureVal = analogRead(A0);       // read the input on analog pin 0:
  Serial.println(moistureVal);            // print out the analog Val
  delay(30);
}
```

We have connected the kit with an Arduino, the 'moisture' threshold value found in the sketch above may need to be modified based on what values our sensor outputs when the sensor is completely dry, compared to when the sensor is completely submerged in water.

Conduct a test using a bowl of water. Make note of the analog value when the probes are not in water. Submerge it in a shallow glass of water, and watch the analog value drop. Conduct another test, this time using soil. Get measurements when the soil is completely dry.

Do the same when the soil has been watered but be careful not to over-water it. View the readings in the Serial Monitor in the Arduino IDE by clicking on Tools > Serial Monitor. The more water content in the soil, the lower the analog measurements will be.

4.3 Stimulation Diagram

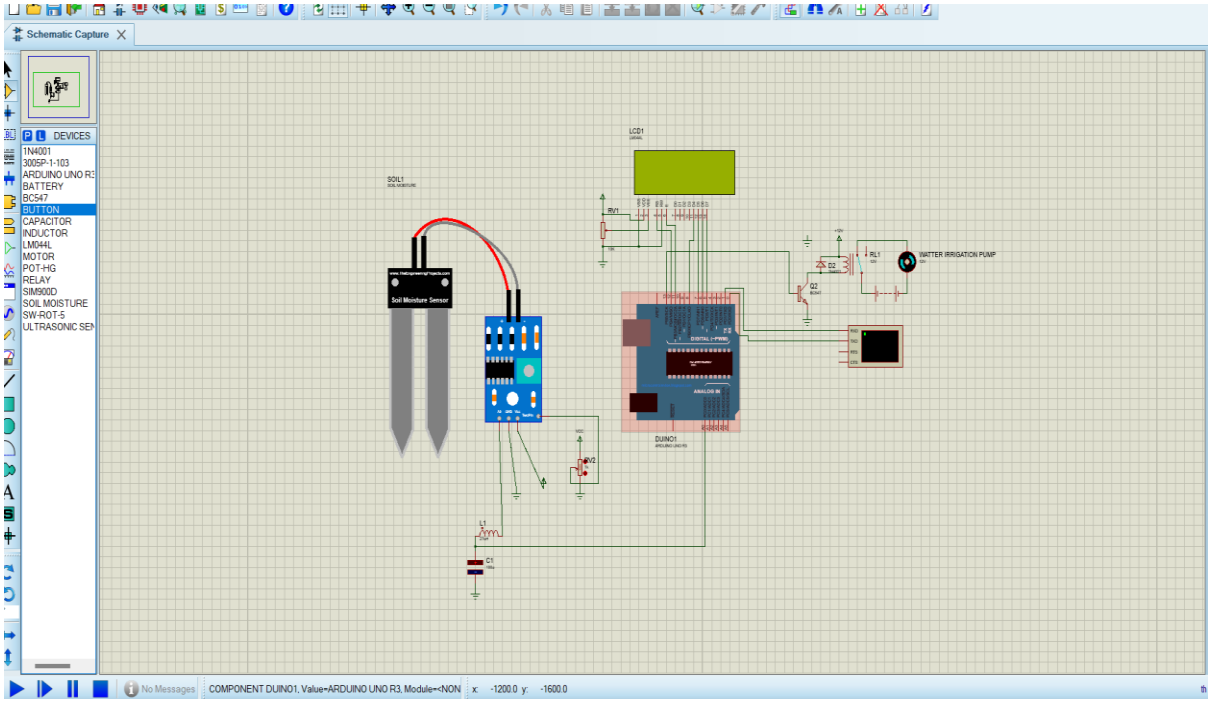

Figure 4.3 Stimulation Diagram

CHAPTER-5

RESULT AND DISCUSSION

From this work, we can control the moisture content of the soil of cultivated land. According to soil moisture, water pumping motor turned on or off via the relay automatically. This saves water, while the water level can be obtained in a preferred aspect of the plant, thereby increasing productivity of crops. Servo motor from vegetation water uniformly dispersed in water, in order to ensure the maximum utilization of absorption through. Thus, there is minimal waste of water. The system also allows the delivery to the plant when needed based on the type of plant, soil moisture, and observed temperature. The proposed work minimizes the efforts of major agricultural regions. Many aspects of the system can be customized and used software to fine-tune the requirements of the plant. The result is a scalable, supporting technology. Using this sensor, we can see that the soil is wet or dry. If it is dry, the motor will automatically start pumping water.

CHAPTER-6

CONCLUSION

This is a low budget project which the farmers of the country can easily afford and can be further improved using technology. This project solves the problem of manual watering and saves a lot of time user. It also focuses on conserving water with increased accuracy in water distribution to the crops and energy. This project includes monitoring soil moisture and supplying water uniformly to the plants using sprinkler or drip system. The main advantage of the system is that it only turns the water pump on when its needed and instantly turns off when the water is sufficient. In this way, it prevents wastage of water and ensures the appliance of water optimally. In the future, we have a plan to consider more criteria in determining perfect timing for watering and apply the whole system for large firm land. As the system is optimized for perfect timing of watering, it may help the plants to remain healthy and grow perfectly. Thus the system would not only keep the plants alive, but also facilitate to grow up in a healthy way.

REFERENCE:

1. Manisha Mayuri, Priyanka Aishwarya, prof. Bagubali A published "Automatic Plant Watering System" in International Conference-2019 (ViTECoN).
2. Ahmed Imteaj, Tanveer Rahman, Mohammed Shamsul Alam, and Touhidul Alam published "Automated Expedient Watering System for Small Plants and Acquaintance Deficit in Water Supply" in ICERIE-2017.
3. Rakhade R.D, Patil N.V Published "Design and Manufacturing of Automated Agricultural Irrigation System" in International Journal of Technical Innovation Modern Engineering and Science, Volume 4, Issue 8, Aug-2018.
4. Punitha.K, Shivaraj, Sudarshan Gowda, Devarajnayaka R, Jagadeesh Kumar H. B. "Automated Plant Watering System" in INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH & TECHNOLOGY (IJERT) ,24-04-2018
5. Ipin Prasojo1, Andino Maseleno2, Omar tanane3, Nishith Shah "Design of Automatic Watering System Based on Arduino" Journal of Robotics and Control (JRC)Vol. 1, No. 2, 2020, March 2020, pp. 55-58.
6. Khin Thandar Tun , Hay Man Oo , Cho Thet New, "AUTOMATIC PLANT WATERING SYSTEM USING ARDUINO" © IJCIRAS | ISSN (O) – 2581-5334August 2019 | Vol. 2 Issue. 3.
7. Rohit Kumar Dulani1, Sanket Gapat2, Deven Nalawade3, Atharv Parbalkar4, Ali Aslam5 Pruthviraj Mashalkar6, "Automatic Plant Watering System using Arduino" International Journal of All Research Education and Scientific Methods (IJARESM), ISSN: 2455-6211, Volume 9, Issue 6, June -2021.
8. Tasneem Khan Shifa, " Moisture Sensing Automatic Plant Watering System Using Arduino Uno" American Journal of Engineering Research (AJER), e-ISSN: 2320-0847 , Volume-7, Issue-7.